RAILROAD GAZETTE

FRIDAY, MARCH 4, 1904.

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## Contributions

### Untrained Telegraph Operators.

Chicago, Feb. 10, 1904.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I presume that you will lay before your readers the paper on the railroad telegraph service that was read by Mr. Browne at the last meeting of the St. Louis Railway Club. It seems to me that this is an important subject. It has waited long for this little bit of attention. How often does the thoughtful traveler observe, with undefined misgivings, the youth and evident inexperience of telegraph operators at small railroad stations. These are positions of responsibility, and the railroads are justly subjected to unpleasant criticism, especially when a mistake on the part of some such operator has caused a wreck. Telegraphy is easily learned and to the boy desiring to go into railroading it offers one of the easiest and most interesting avenues of entrance; but what a risk is involved! But a boy is content with a salary that would not be an inducement to a person of maturer years and judgment, and so boys are employed. Who could expect that operators of this sort would have a proper appreciation of the gravity of the responsibility resting upon them? Mr. Browne asserts that, with some exceptions, the general qualification of railroad operators is far below what it was ten years ago, and he suggests the formation of a telegraph school by the united action of the large railroads. I do not know whether that is a good idea or not; I leave the question to you; but from the standpoint of the passenger, trusting his life to the tender mercies of perhaps a hundred operators in a thousand-mile journey, the salary argument would seem to be worthy of more prominence. Mr. Browne does not mention this. The salary attached to these positions should be sufficient to induce men of suitable age and judgment to seek them. With the vacancies being filled with material of this sort, encouraged by the assurance that advancement would reward a good record, the telegraph department would soon reach a high plane of efficiency.

F. C. H.

[An abstract of Mr. Browne's paper is given in another column.]

### Uniformity of Tractive Effort.

Cincinnati, Ohio, Feb. 23, 1904.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The discussions which have been published in the *Railroad Gazette* regarding the turning moments of the compound locomotive, bring to mind some experiences. The writer had occasion to examine some dynamometer diagrams and the corresponding indicator cards. It was somewhat of a surprise to see that in spite of the wide variation in the tractive effort, there was practically no variation in the drawbar pull diagram, although the dynamometer was extremely sensitive. This led to the following calculation which shows up the actual conditions quite well.

The data are about as follows:

| | |
|---|---|
| Maximum tractive effort | 7,000 lbs. |
| Minimum tractive effort | 3,000 " |
| Weight of engine without tender | 110,000 " |
| Diameter of drivers | 66 in. |
| Speed | 20 m. p. h. |

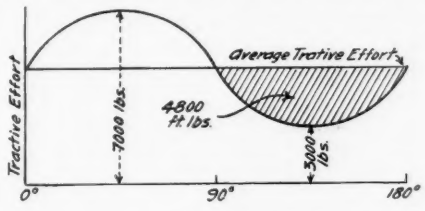
Kinetic energy of locomotive, exclusive of rotative energy is $\frac{1}{2} \times \frac{110{,}000}{32.16} \times$ (velocity in ft. per sec.)$^2$, or 1,471,200 ft. lbs. The work required to raise the minimum tractive effort to equal the average tractive effort is 4,800 ft. lbs. The kinetic energy of the locomotive (exclusive of rotative energy of the wheels), after giving up 4,800 ft. lbs. to equalize the minimum tractive effort is 1,466,400 ft. lbs., and the velocity corresponding to 1,466,400 ft. lbs. is—

$$\sqrt{\frac{1{,}466{,}400 \times 2 \times 32{,}16}{110{,}000}} = 29.28 \text{ ft. per sec.}$$

The original velocity is 20 m. p. h., or 29.33 ft. per sec. Therefore the loss in velocity is 0.05 ft. per sec., which takes place in ¼ revolution, or in 0.15 of a second. This corresponds to a negative acceleration of $\frac{.05}{.15}$ or 0.33 ft. per sec. The actual longitudinal motion during 0.15 of a second or ¼ revolution is

½ acceleration × (time)$^2$ = ½ × .33 × (.15)$^2$ = .0037 ft.

This same calculation applies to the case of equalizing the maximum tractive effort. The conclusion is, therefore,




that in order to have absolutely uniform drawbar pull, the variation in velocity of the engine would have to be $2 \times \frac{.05}{29.33}$ or — 0.33 per cent. and the motion at the drawbar of the engine would be 2 × .0037 = 0.0074 ft. In short, the flywheel capacity of a locomotive is extremely high.

A. L. KUEHN.

### The Influence of Railroads on Latin-American Stability.

*By* EDWARD P. NORTH, *M. Am. Soc. C. E.*

For some time European publicists have asserted that if we do not police the Latin-American countries to the south of us Europe will. Some of our own writers regard this proposed action in an apparent spirit of complacency and acquiescence. But none of them seems to be giving their attention to any project which might enable these republics to develop stable and prosperous governments of and for themselves. This seems remarkable with the example of Mexico before the eyes of all.

During the 59 years that elapsed between the independence of that country and our advent therein as railroad builders Mexico had an unascertainable number of revolutions and 48 rulers; Benito Juarez holding the office of President for 17 of those years, Maximillian being one of the other 47 during a part of the terms covered by Juarez. Since Mexico commenced subsidizing and building railroads its government has been as stable as any. There have been no more revolutions, hardly a riot. As Señor Romero says: Former revolutionists "are now interested in the maintenance of peace, because they are thriving in consequence of the development of the country." This development would have been impossible if it had not been for the policy of President Diaz, which had been the main cause of railroad building in that country.

Our own history is not entirely devoid of precedents of this kind. In 1860, before our Civil War, there was but one direct rail route through the North and South, viz.: the present Illinois Central between Chicago and New Orleans. There were also two lines of possible travel to Savannah, one through Chattanooga and another about as long down the coast. It was said some 15 or 18 years ago that if the South has possessed in 1860 the manufacturing capacity of that present time secession would have been successful. The reply was in that case secession would have been impossible. Both assertions were probably true. It may be equally correct to say if the present facilities of intercommunication between the South and the North had been in existence in 1860 secession would have been at least improbable.

Recognition of the influence of convenient, cheap and frequent intercommunication between different sections on friendly relations between them induced the patriotic statesmen of that period to give land grants and lend money to the Union and Central Pacific railroads, thereby insuring their early completion at a time when public confidence in their commercial necessity may be partly gaged by the fact that in the December that followed the joining of the two tracks the stock of the Union Pacific Railroad sold for 4 cents on the dollar. But all fear of serious sectional difficulties between the Pacific and Atlantic coasts has long been eliminated. Incidentally the region which Major S. H. Long, of the U. S. Topographical Engineers, thought in 1820 "may prove of infinite importance to the United States, inasmuch as it is calculated to serve as a barrier to prevent too great an extension of our population to the westward and secure us against the machinations or resources of an enemy that might otherwise be disposed to annoy us in that part of our frontier," now contains about half the population and decidedly more wealth than the whole Union held when the Major thought it fit only for buffaloes and wild goats, as he called the antelope. The easy communication made possible and prevalent by our railroads have made the careful and intelligent prevision of the anti-imperialists of that day absurd.

Security to life and property with freedom from revolutionary attempts, accompanied by commercial confidence in the future prosperity of Latin-American countries generally seems closely connected with the railroad mileage of those countries.

The following table, taken from the *Railroad Gazette*, gives the latest data available, showing the miles of railroad opened, with the number of inhabitants and area in square miles per mile of railroad, for the year 1900:

*Miles of Railroad Opened in* 1900.

| Countries. | Miles of railroad open. | —Per mile of railroad— Inhabitants. | Sq. miles. |
|---|---|---|---|
| British North America.... | 17,831 | 294 | 189.9 |
| United States ..... | 193,304 | 383 | 15.5 |
| Mexico ..... | 9,055 | 1,394 | 84.7 |
| Central America ..... | 718 | 3,313 | 230.3 |
| Venezuela ..... | 634 | 3,856 | 635.7 |
| Colombia ..... | 400 | 11,250 | 1,284.6 |
| Ecuador ..... | 634 | 3,856 | 635.7 |
| Brazil ..... | 9,195 | 1,845 | 351.1 |
| Argentina ..... | 10,171 | 471 | 109.5 |
| Paraguay ..... | 157 | 3,197 | 621.9 |
| Uruguay ..... | 1,144 | 723 | 60.3 |
| Bolivia ..... | 621 | 3,934 | 829.7 |
| Chili ..... | 2,850 | 1,053 | 105.1 |
| Peru ..... | 1,036 | 2,876 | 420.1 |

Very little is to be said of the above table, except possibly to call attention to the fact that the railroads of both British North America and Mexico are closely connected with those of the United States, forming a combined system composing nearly a moiety of the railroad mileage of the world. In Central America, on the other hand, the small mileage they have is without continuity or connections. The Argentine Republic until 10 or 15 years ago had an unpleasant reputation for revolutions, but in the decade ending with 1890 the railroad mileage of that country was quadrupled, bringing it up to 5,745 miles. The house of Baring was the principal promoter of this beneficence to Argentina and the world. This work was done without expectation of advantage to our western wheat growers and without ultimate gain to the promoters. But the long record of violent government changes in Argentina is apparently closed; that republic taking a place among the stable governments of the world. The men who led the revolutions now lead productive enterprises with reasonably certain incomes.

The development of commercial confidence in the future of Mexico, referred to above, has been phenomenal. In 1880, when President Diaz inaugurated his policy of internal improvements, that country, with an approximate population of 10,000,000, had 671 miles of isolated railroads, or one mile for 14,900 inhabitants. Then attempts at revolution, national and state, were frequent, and over large areas neither life nor property were safe. Few admitted the possibility of a stable government. Mexico was substantially without credit in the markets of the world. Our entire exports and imports with her in 1880 amounted to 13¼ million dollars; last year they were nearly 85 millions. And this with an increase of her trade with foreign countries, though they undoubtedly have to sell her better goods at lower prices than before. During this period her manufactures have increased nearly as fast as her trade with us. Her 5 per cent. bonds are now selling at 98, life and property are safe, and no one fears any manifestation of an unfriendly disposition from or towards that country even after the death of President Diaz, a misfortune that unhappily is certain to occur. The development in both national pride and in production and consumption which has followed the cheapened facilities for transportation assures her onward march in stable prosperity.

The above cited figures will, I hope, justify the assertion that Central and Colombian America can only receive the advantages which accompany a settled government through building of trunk line railroads eventually connecting the railroad system of Mexico with those of Chili and Argentina. Such a trunk line would bind all Latin-America together, giving those states some such influence, power and unity as our rapid means of intercommunication has given to this country. Concurrently their increased power of production and consumption would make a welcome addition to the commerce of the world, and their unsettled but accessible areas would be a boon to the inhabitants of all congested countries. But the chief beneficiaries of such a railroad extension would undoubtedly be the United States and Mexico to the north, with Argentina and Chili to the south. For, as Senator Beveridge says: "Wherever a line of railroad goes trade goes. And where a line of railroad goes the trade of the nation which built it is chiefly carried," as is evinced by our rapidly increasing trade with both Mexico and Canada.

In view of transatlantic influences here, which have shown pronounced hostility to any extension of our railroad-borne trade to the southward, it is possibly idle to suggest the loan of our government's credit to an enterprise that will add so much to our commerce, while developing the self-respect and prosperity of our neighboring republics, but there seems no objection to a promise of sufficient payment per mile to induce the prompt and frequent carriage of our mails. That would be merely a payment for services rendered and not objectionable as a subsidy.

It has been lately said, by one vouched for as an authority, that the Pan-American Railroad could not

carry diamonds as through freight. In Boston those curious in such matters still preserve a report by a great economic authority which says the Atchison, Topeka & Santa Fe R. R. could not find freight enough in the region it proposed to traverse to pay for the grease on its axles. This expert, like Major Long, overestimated the value of a doubtless honest prevision and the authority on handling diamonds may be predicting on an inverted imagination. But there is not sufficient commercial confidence in the freight and passenger producing capacify of the countries south of Mexico to permit building the railroads necessary to their secure government and prosperity with the accompanying extension of the wealth and commerce of the United States and Mexico unless government aid of some kind can be extended to the enterprise, for our best thought insists rigorously that no philanthropic purpose shall enter into a business transaction.

## A Comprehensive Brief.

In the Southern lumber rate cases now pending before the Interstate Commerce Commission the issues were more clearly defined than usually occurs in complaints covering a large number of shipping points and also widely scattered destinations, and the argument of Mr. Ed. Baxter, the Counsel for the Louisville & Nashville, set forth the railroad side of the case very succinctly. The argument of the lumbermen appears to have been embraced in a single count—that they cannot sell lumber far enough from home to keep their business at the desired high level of prosperity. The cases concerned the 16 cent freight rate on yellow pine from shipping points in the Southern States to Ohio River crossings. The two main cases were brought to test the legality of the two cents advance on the rate established in 1893 (14 cents). The contention of the lumbermen is that the 14 cent rate was too high when fixed, and that its maintenance through subsequent years of prosperity and large increase in business was unjust. They went into railroad management and attacked the corporations generally. Mr. Baxter said, in substance:

"The advance was not the result of agreement, but of the independent action of the different lines interested. The rates in question were made on the Cairo combination, being composed of the rate from Georgia points to Cairo plus rates of northern lines from Cairo to destination.

"By whatever route or crossing the business moves the through rate is the same as the Cairo combination. The line north of each Ohio River crossing is allowed its full rate, and the line south shrinks its proportion if necessary.

"After allowing the originating lines a liberal proportion, the roads leading from Macon and other gateways to the Ohio River receive a small proportion. The lines north of Macon have in the past stood all reductions necessary to meet Arkansas competition, and the present advance is in their proportions. The lines south of Macon have not participated in the reductions heretofore made to Cairo to meet Arkansas competition and do not share in the advance of two cents per 100 pounds.

"The railroads claim they are entitled to advance the rate by reason of increased cost of labor, materials and equipment. While their gross earnings show large increases, net earnings are not increasing in proper ratio, and the railroads claim that additional revenue is necessary. There have been advances in the past on many other articles, and lumber is the last of the important commodities on which the advance has been made.

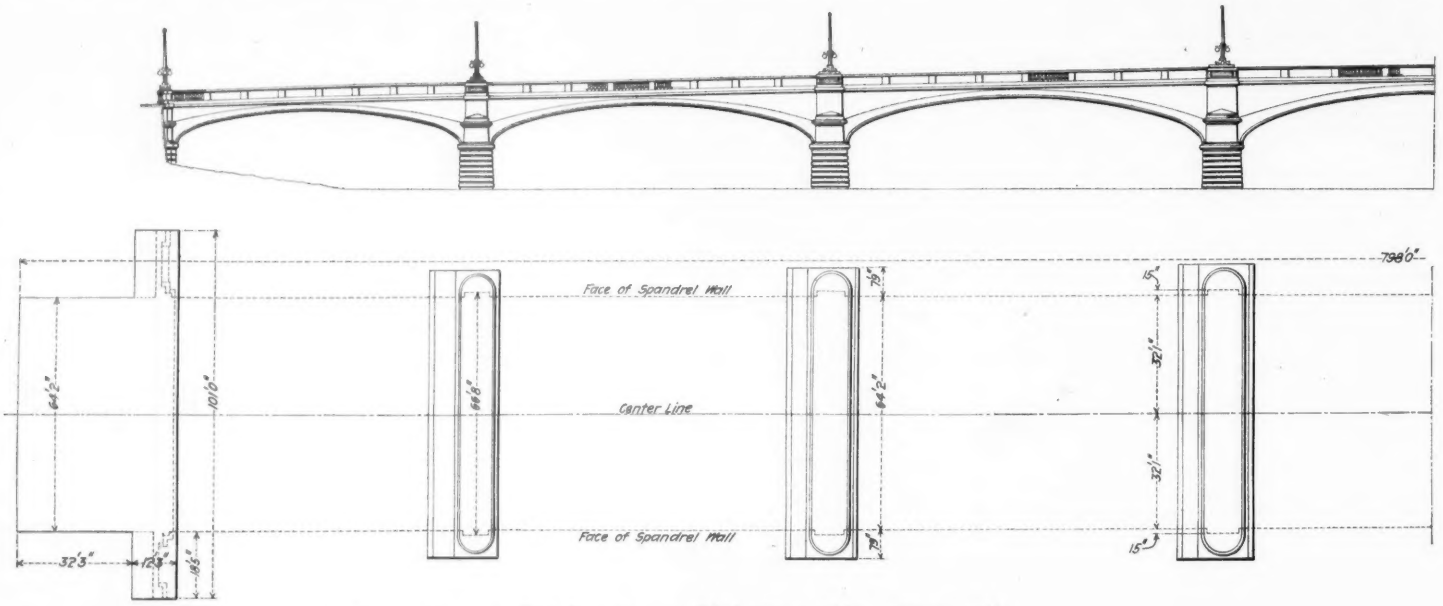
"The average rate per ton per mile yielded by the present proportions up to the Ohio River on Georgia lumber is 5.17 mills, and this is lower than is yielded by other lumber rates in the United States. The Georgia lumber is handled largely on flat cars, a large proportion of which have to be sent south empty. It is therefore claimed that lumber is not a highly profitable traffic, and that the advanced rate was proper, necessary and just.

"The southern railroads were the pioneers in developing the northern market for yellow pine. They used it in their car construction and advertised it through their soliciting agents. They would hardly now put into effect an advance which would undo the results of their years of effort.

"Rates from time to time in the past have been reduced to meet depressed conditions and the present advanced rate does not amount to a restoration of the tariffs in effect prior to 1890. Statistics filed by the railroads show increased movements since the advance of June 22, 1903, and disprove the allegation that southern pine has been shut out of the northern market.

"Prices of lumber have materially advanced in recent years and that fact justifies an increase in freight rates.

"The defendants in 1902 distributed for interest on funded debt and dividends an amount equaling 4 per cent. interest on an average capitalization of $26,853 per mile. The total capitalization per mile of railroads in the United States for 1902 was $62,301, and said amount—$26,853—being materially less, shows they are not earning more than a fair return."




Plan of Piers and Half Elevation of Third Street Bridge, Dayton, Ohio.

## Melan Concrete-Steel Bridge at Dayton, Ohio.

Bids were opened Dec. 22, 1903, for the construction of a new concrete-steel bridge (Melan system) across the Great Miami River at Third street, Dayton, Ohio. The bridge is to be built in seven arches, with a total length between abutments of 710 ft. and a width of 62 ft. between balustrades. It replaces an old structure now in use and the contract covers the removal of the old bridge and the construction of a temporary pile and timber trestle bridge to one side of the permanent site which will be used during the construction of the new bridge. The bids received ranged between $179,600, the lowest, and $340,000, there being 13 tenders submitted.

The Great Miami at this point runs almost due south and the center line of the bridge is at right angles to the direction of the current. The river bed is fairly level and of firm nature. At low water, part of the bottom is exposed and at no place is the depth of water greater than 6 ft. The foundations for the piers will rest directly on the hard pan under the thin layer of gravel and silt, but in case soft bottom or quicksand is found near any of the piers the plans provide for a pile foundation suitable to carry the load, on which the grillage and concrete base of the piers will rest. These conditions are very favorable for the rapid and economical construction of a flat arch concrete-steel bridge, such as is proposed.

Though of different spans and rise, the seven arches are symmetrical about the center span. They have the following dimensions: Nos. 1 and 7, span 80 ft., rise 9.67 ft.; Nos. 2 and 6, span 90 ft., rise 11.3 ft.; Nos. 3 and 5, span 100 ft., rise 13.25 ft.; No. 4, span 110 ft., rise 14.25 ft. The maximum ratio of span to rise, 8.1 to 1, is in arches 1 and 7 and the minimum ratio of 7.4 to 1 is in arches 3 and 5. The arches are all elliptical, struck with four radii. The roadway is 42 ft. wide and will carry a double-track street car line. It is flanked on both sides with 10-ft. sidewalks, the grade on the bridge being 2 per cent. from both ends towards the center.

Foundations for the piers and abutments will be sunk in open coffer dams of tongued and grooved sheathing at least 4 in. thick. In case the bottom is porous and leaks beyond the capacity of the pumps, the contractor will be permitted to place concrete over the bottom by means of chutes until it is well calked, after which the water is to be pumped out and the remainder of the concrete deposited in the air. All concrete deposited under water is to be composed of 1 part Portland cement, 2½ parts of sand and 6 parts of clean gravel. The foundation proper for each pier consists of two courses or steps of concrete. The bottom step is 4 ft. thick for all the piers and has all four sides perpendicular. It extends out beyond the arch ring on each side between 7 and 8 ft., varying for the different piers, and has a width, measured along the center line of the bridge, of from 19 ft. 6 in. to 21 ft. 6 in., depending on the pier. The top course is 4 ft. 6 in. thick and is backed off on a slope of 45 deg. on the face nearest the abutments; the top of this second course is about 2 ft. below low water. The piers rise from the foundations with a batter on the faces of 1 to 24 up to the cap moulding or soffit, under the springing line of the arch. The up-stream and down-stream nosing faces are rounded to semi-circular form and all the faces are fluted to relieve the effect of the massive lines. The tops of the piers are brought up to a ridge as shown in the longitudinal section, the faces of the ridge being normal to the line of thrust of the arches. A 1:3:7 mixture of concrete is to be used in the piers and abutments for all work done in the open air. Thacher bars, 1¼-in. in diameter, are built in the concrete in two rows or layers, one layer placed 1 ft. above the bottom of the first foundation course and the other placed vertically, close to the face of the pier nearest the center of the bridge and extending from the bottom of the foundation up through the haunch of the arch masonry. The number and spacing of the bars is varied in proportion with the calculated loading on the piers.

The east abutment is made the width of the arches, with wing walls extending out 18 ft. 5 in. on each side. The bottom is laid on a slope of 1 to 11 and successive layers of concrete are laid to conform to the dotted lines shown in the section, each layer being inclined more and more toward the arch as the height increases so that at the springing line the joint is normal to the line of thrust. No reinforcing bars are used in the abutments. The west abutment is practically the same as the one at the east end except that on account of the approach being on a curve, the north wing wall is extended out on the same curve instead of on a straight line. The wing walls are 12 ft. 3 in. wide on the foundation and 9 ft. 8½ in. thick at the bottom, rising to the coping with a batter of 1 in 12 on the river face and 1 in 2½ on the rear face. Both the abutments and wing walls are to be of a 1:3:7 mixture of concrete.

The construction of the concrete-steel arches is clearly shown in the detail drawings of arch No. 1. In all of the other spans the construction is substantially the same, except that heavier sections are used in the steel trusses. The steel reinforcement consists of 22 parallel trusses of the shape of the arch section spaced across the arch, 34 in. apart, and bedded in the concrete of the piers and abutments. These trusses are made up of a top and bottom chord of two angles each, connected with a single lattice work throughout their length. The separate trusses are not connected together during erection except in the anchorages in the piers and abutments, where they are tied with two or more angles extending the width of the arch. Over each pier the top chords of the trusses of adjacent spans are spliced together, forming a continuous reinforcement along the length of all seven arches. The top and bottom chords in each arch are also spliced at the crown and just beyond the haunches. In arches 1 and 7, the size of angle used is 2½ in. x 2½ in. x $^5/_{16}$ in., and in all the others 3 in. x 3 in. x $^5/_{16}$ in. angles are used, with 1¾-in. x ¼-in. lattice bars throughout.

In framing the centers for the arches, allowances will be made for settlement of centers while the work is in progress and for the permanent cambre and deflection of the arch after the centers are removed. The tendency of the centers to rise at the crown as they are loaded at the haunches will be taken care of by loading the crown and afterwards regulating the load to prevent distortion of the arch as the work progresses. The specifications provide that the centers be framed for a rise of arch greater than the assumed rise by an amount equal to one eight-hundredth part of the span, which makes allowance for the permanent set of the concrete to the established lines of the arch.

A machine mixed concrete of 1 part cement, 2 parts sand and 4 parts broken stone will be used in the arches.

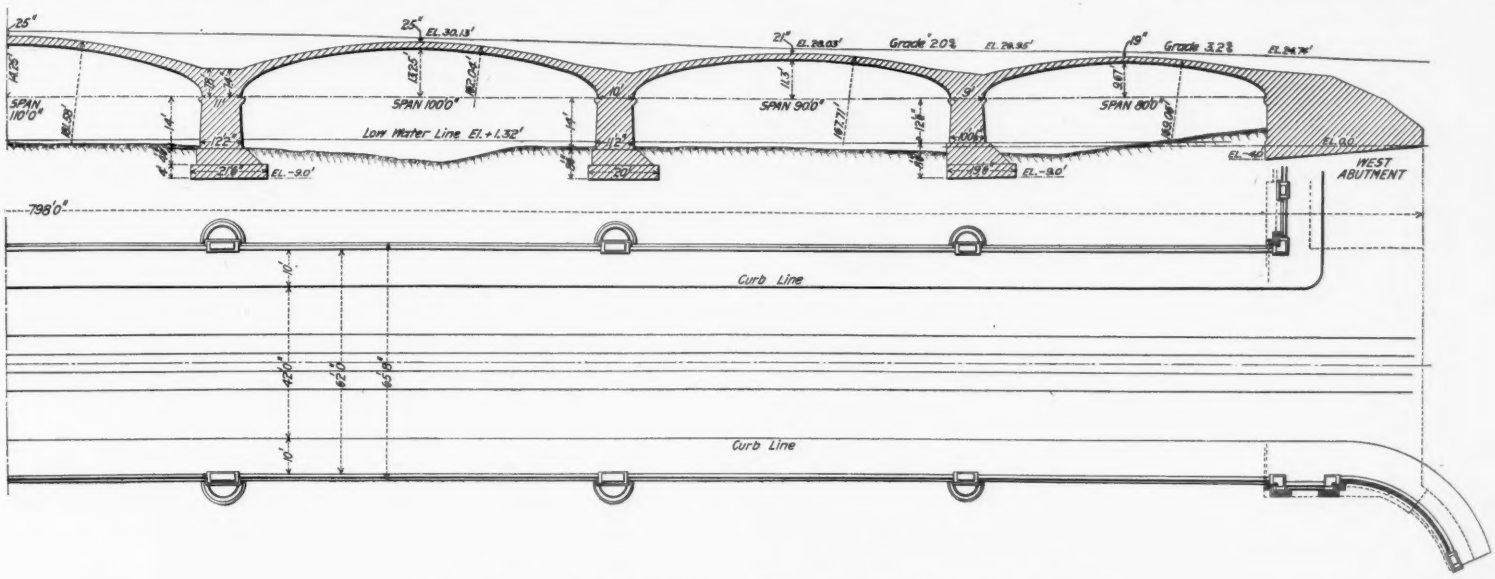
Concreting will be started simultaneously from both haunches in longitudinal sections, wide enough to include three steel ribs, each layer being well rammed before the previously deposited layer has taken its initial set. Each of these sections will be built as continuous work. They will be held in place by substantial timber forms with sides parallel, which will be removed after the concrete has taken its initial set. Adjacent sections will be connected in the usual manner for joining old and new concrete by wetting down and slushing with cement grout. Each two steel ribs between which there is a dividing plane of two adjoining sections of concrete will have the top and bottom flanges clamped together with by straps, ¼ in. x 2 in., bent around and under the flanges. These clamps will be spaced about every 10 ft. On account of the flatness of the arches the centers will not be removed until four weeks after the completion of the concrete work on the last arch and after the earth filling over the haunches has been placed.

The copings, balustrades and parapets on the wing walls will be made of concrete of a 1:2:4 mixture, faced with ¾ in. of cement mortar in the proportion of 1 of cement to 2½ of sand, applied in the molds or forms and in no case to be plastered on after the molds have been removed. After the completion of the arches and spandrel walls and before the fill is put in, all of the exposed inside surfaces will be given a thick coat of cement grout and after this has set hard a coat of pitch ⅛ in. thick will be applied. At each pier provision for drainage has been made in the plans by embedding four wrought iron pipes in the concrete, 15 ft. apart and extending from the space over the piers just above the springing line out through the pier to a point 3 in. below the soffit or cap moulding. Sumps will be formed in the surface of the concrete so that any water which seeps through the fill will be run off. The line of drainage will be covered with a layer of broken stone and the top of the drains protected with a screen.

flange areas of not less than the one houndred and fiftieth part of the total area of the arch at crown.

Steel in the arch ribs must have an ultimate strength of from 60,000 to 68,000 lbs. per sq. in., an elastic limit of at least half the ultimate strength and show an elongation in 8 in. of 20 per cent., with a reduction of area of 40 per cent.

The bridge is being built under the consulting supervision of the Concrete-Steel Engineering Company, New York, which owns the patents on the Melan system which is to be used. The plans and specifications were drawn up under its direction, and as a royalty it receives




**Part Section and Plan of Roadway of Third Street Bridge, Dayton, Ohio.**

In calculating the stresses in the bridge the following conditions were assumed:

| | |
|---|---|
| Dead load—Concrete | 150 lbs. per cu. ft. |
| Fill | 120 lbs. per cu. ft. |
| Pavement | 150 lbs. per cu. ft. |
| Live load—For roadways and sidewalks | 150 lbs. per sq. ft. |
| Concentrated moving load | 40-ton electric car |
| Modulus of elasticity of concrete | 1,500,000 lbs. |
| Modulus of elasticity of steel | 30,000,000 lbs. |
| Maximum stress on concrete— | |
| Compression, excl. of temp. stresses | 500 lbs. per sq. in. |
| Tension, exclusive of temp. stresses | 50 lbs. per sq. in. |
| Shear | 75 lbs. per sq. in. |

Maximum stress on steel in arches—

The steel ribs under a stress not exceeding 18,000 lbs. per sq. in, must be capable of taking the entire bending moment of the arch without aid from the concrete, and have

$12,000, to be paid out of the contract price. Chas. Hoglan, of Dayton, Ohio, whose bid of $179,600 was the lowest submitted, received the contract at that price. F. M. Turner is City Civil Engineer, in charge of the work.

We are indebted to the Concrete-Steel Engineering Company for the drawings and a copy of the specifications.

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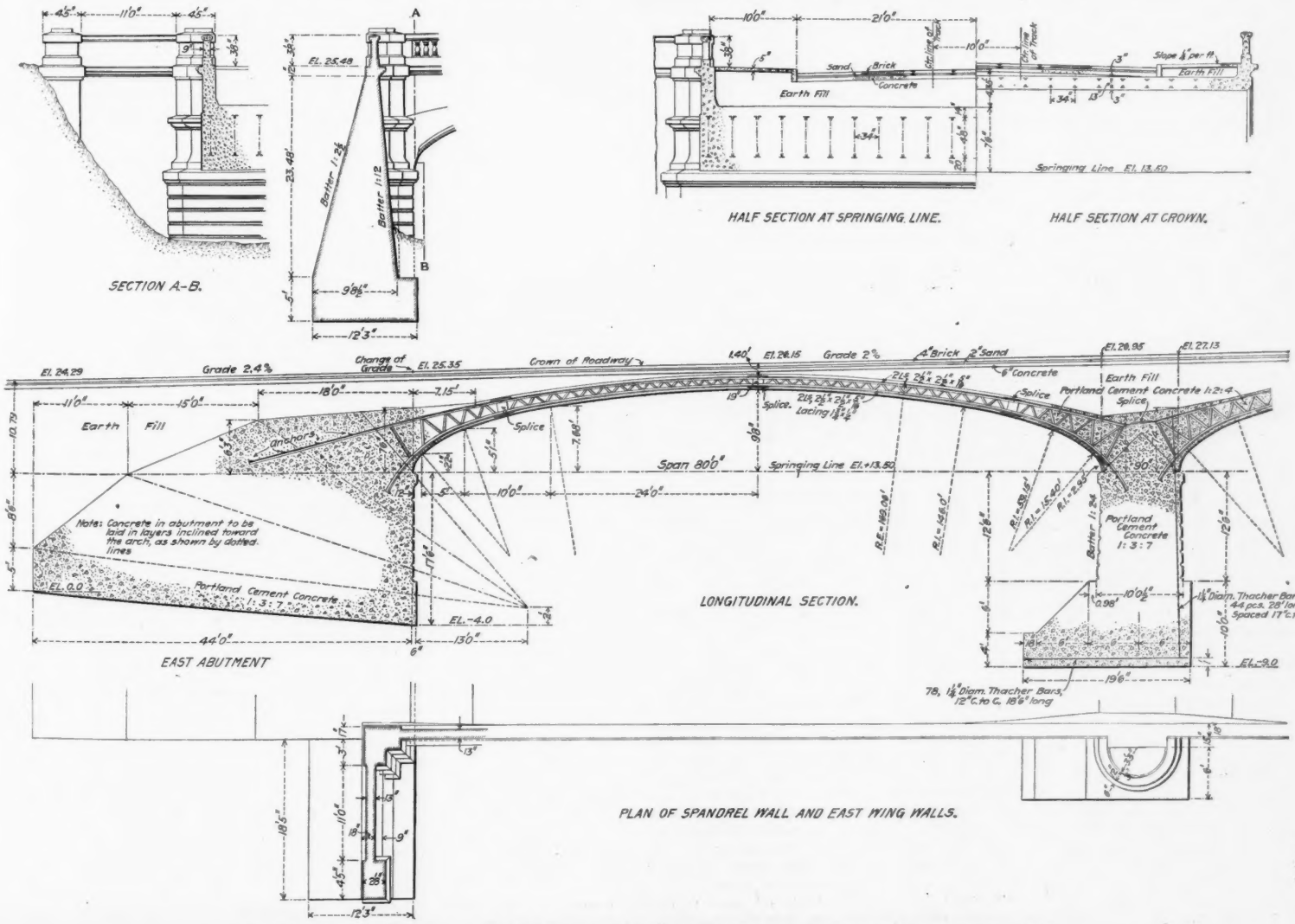
The Siamese Railroad, built and managed by German engineers, but belonging to the State, rejoices in an increase of about 30 per cent. in earnings last year, yielding net 3.8 per cent. on its cost, which has been about $5,550,000 for 190 miles. It may be remarked that 99 per cent. of the passengers rode third class.


SECTION A-B.
HALF SECTION AT SPRINGING LINE.
HALF SECTION AT CROWN.
LONGITUDINAL SECTION.
EAST ABUTMENT
PLAN OF SPANDREL WALL AND EAST WING WALLS.
Earth Fill
Portland Cement Concrete 1:3:7
Span 80'0"
Springing Line El.+13.50
Grade 2.4%
Grade 2%
Crown of Roadway
Change of Grade
Note: Concrete in abutment to be laid in layers inclined toward the arch, as shown by dotted lines
78, 1¼" Diam. Thacher Bars, 12" C. to C. 18'6" long
1¼" Diam. Thacher Bars, 44 pcs. 28' long, Spaced 17" C. to C.

**Details of East Abutment and Adjoining Arch—Melan System Concrete-Steel Bridge at Dayton, Ohio.**

## Fuel Tests on the Furness Railroad, England.

At the September meeting of the Iron and Steel Institute of England, Mr. W. F. Pettigrew, Locomotive Superintendent of the Furness railroad, read a paper describing and giving the results of a series of tests made for the purpose of determining the fuel value of several grades of coal. Inasmuch as the prices at the mines, cost of hauling and the quality of the coal from the Cumberland, Lancashire and Yorkshire districts varies considerably, it was thought expedient to make thorough tests. A six-wheel coupled freight engine was used and the tests were made while the engine was in regular service hauling lbs., and per indicated horse-power per hour, 20.3 lbs. The amount of steam used by the steam brake cylinder was not taken into account. Indicator diagrams were taken from each cylinder every five miles.

The maximum indicated horse-power given by any one set of diagrams was 820, with a mean cut-off of 40 per cent., taken during the trial of Scotch coal No. 3 while ascending a gradient of 1 in 63, the speed being 23 miles per hour, the number of revolutions 138 per minute, and the boiler pressure being 148 lbs. per sq. in. The minimum indicated horse-power was 234, with a cut-off at 16 per cent. on a down gradient of 1 in 714, taken during the trial of Cumberland coal No. 1, the speed being 22 605 tons exclusive of engine and tender, and the minimum load 261 tons. The coal consumed per train mile, divided by the average number of tons hauled, gives the pounds of coal consumed per ton hauled per mile. The minimum consumption obtained was during the trial of Yorkshire coal No. 3, the result being a consumption of 0.111 lbs. per ton mile. It was found, however, the results obtained by this method were not altogether satisfactory, as no allowance could be made for wind, rain, or greasy rails, which would cause an increased consumption, so that should one sample be tried with a dry rail and practically no wind, although it may be an inferior coal, the results recorded on this basis would probably

RESULTS OF FUEL TESTS ON THE FURNESS RAILROAD, ENGLAND.

TABLE I.

| Coal Consumption. | Yorkshire. A. | | | | | Welsh. B. | Lancashire. C. | | Cumberland. D. | | Scotch. E. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1. | 2. | 3. | 4. | 5. | 1. | 1. | 2. | 1. | 2. | 1. | 2. | 3. | 4. | 5. |
| Total coal used, exclusive of lighting up, lbs. | 4770 | 4984 | 5270 | 5068 | 5430 | 4879 | 5292 | 5577 | 4672 | 6283 | 5096 | 6095 | 6023 | 6014 | 6548 |
| Total coal used, inclusive of lighting up, lbs. | 4994 | 5208 | 5494 | 5292 | 5654 | 5103 | 5576 | 5801 | 4896 | 6507 | 5320 | 6319 | 6247 | 6238 | 6772 |
| Coal burnt per hour, running time, lbs. | 886 | 906 | 958 | 893 | 1005 | 887 | 853 | 1014 | 812 | 1064 | 900 | 1050 | 1075 | 1036 | 1128 |
| Coal burnt per hour, steam on, lbs. | 1026 | 1044 | 1108 | 1028 | 1155 | 1027 | 971 | 1169 | 934 | 1233 | 1033 | 1195 | 1250 | 1179 | 1283 |
| Coal burnt per sq. ft. of grate, lbs. | 50.0 | 50.8 | 54.0 | 50.1 | 56.3 | 50.1 | 47.0 | 57.0 | 45.5 | 60.1 | 50.4 | 58.2 | 60.9 | 57.5 | 60.2 |
| Coal burnt per I.H.P. per hour, steam on, lbs. | 2.03 | 2.26 | 2.31 | 2.29 | 2.33 | 2.06 | 2.10 | 2.54 | 2.16 | 2.37 | 2.26 | 2.50 | 2.55 | 2.63 | 2.82 |
| Coal burnt per ton mile, lbs. | 0.115 | 0.132 | 0.111 | 0.122 | 0.142 | 0.117 | 0.126 | 0.127 | 0.118 | 0.148 | 0.123 | 0.134 | 0.133 | 0.161 | 0.140 |
| Coal burnt per train mile, lbs. | 42.58 | 44.5 | 47.0 | 45.25 | 48.48 | 43.56 | 47.25 | 49.70 | 41.71 | 56.1 | 45.5 | 54.4 | 53.77 | 53.70 | 58.46 |
| Coal burnt per engine mile, lbs. | 39.7 | 41.5 | 43.9 | 42.20 | 45.2 | 40.7 | 44.1 | 46.1 | 38.9 | 25.3 | 42.4 | 50.8 | 50.1 | 50.1 | 54.5 |
| Coal burnt per lb. pull on drawbar per mile, lbs. | 0.0087 | 0.00921 | 0.00973 | 0.00975 | 0.00979 | 0.0091 | 0.00954 | 0.01073 | 0.00917 | 0.01022 | 0.00945 | 0.01054 | 0.01107 | 0.01140 | 0.01217 |
| Coal burnt per lb. pull on drawbar per hour, lbs. | 0.1823 | 0.1877 | 0.1979 | 0.1881 | 0.2033 | 0.1871 | 0.172 | 0.219 | 0.178 | 0.194 | 0.187 | 0.203 | 0.2214 | 0.220 | 0.2350 |
| Calorific value of 1 lb. of coal in B.T.U. | 14,256 | 14,107 | 13,266 | 13,404 | 13,266 | 14,206 | 13,414 | 12,424 | 13,414 | 12,790 | 12,721 | 12,672 | 13,315 | 12,523 | 11,583 |
| Percentage of ash | 5 | 5.4 | 5.8 | 7.6 | 5.4 | 7 | 9 | 9.7 | 7.5 | 8.6 | 5 | 5 | 8.1 | 5 | 7.8 |
| Mean boiler pressure throughout journey, lbs. | 145.2 | 140.0 | 142.4 | 143.0 | 142.8 | 144.5 | 139.5 | 140.4 | 139.9 | 140.9 | 142.5 | 142.5 | 141.2 | 141.2 | 139.0 |

TABLE II.

| Water Consumption. | Yorkshire. A. | | | | | Welsh. B. | Lancashire. C. | | Cumberland. D. | | Scotch. E. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1. | 2. | 3. | 4. | 5. | 1. | 1. | 2. | 1. | 2. | 1. | 2. | 3. | 4. | 5. |
| Total water evaporated, lbs. | 47,700 | 48,000 | 48,400 | 47,000 | 50,000 | 49,200 | 50,500 | 45,200 | 46,000 | 54,000 | 47,000 | 50,000 | 47,000 | 45,000 | 48,000 |
| Water evaporated per hour, running time, lbs. | 8,866 | 8,545 | 8,800 | 8,290 | 9,242 | 8,945 | 8,145 | 8,218 | 8,000 | 9,152 | 8,392 | 8,260 | 8,394 | 7,759 | 8,277 |
| Water evaporated per hour, steam on, lbs. | 10,258 | 10,105 | 10,189 | 9,533 | 10,638 | 10,358 | 9,266 | 9,476 | 9,200 | 10,384 | 9,533 | 9,804 | 9,730 | 8,823 | 9,411 |
| Water evap. per sq. ft. of htg. surface per hr., lbs. | 9.14 | 9.0 | 9.08 | 8.4 | 9.46 | 9.23 | 8.09 | 8.35 | 8.11 | 9.25 | 8.4 | 8.65 | 8.58 | 7.78 | 8.29 |
| Water evaporated per I.H.P. per hour, steam on, lbs. | 20.3 | 21.9 | 21.2 | 21.4 | 21.2 | 20.8 | 20.0 | 20.6 | 21.3 | 20.0 | 20.8 | 20.5 | 19.9 | 19.7 | 21.2 |
| Water evap. per I.H.P. per hour, running time, lbs. | 17.5 | 18.5 | 18.3 | 18.6 | 18.4 | 18.0 | 17.6 | 17.8 | 18.5 | 17.6 | 18.3 | 18.0 | 17.1 | 17.3 | 18.6 |
| Water evaporated per train mile, lbs. | 425 | 428 | 432 | 419 | 446 | 439 | 450 | 403 | 410 | 482 | 419 | 446 | 419 | 401 | 428 |
| Water evaporated per engine mile, lbs. | 397 | 400 | 403 | 391 | 416 | 410 | 420 | 376 | 388 | 450 | 391 | 416 | 391 | 375 | 400 |
| Water evap. per lb. of coal, incl. lighting up, lbs. | 9.55 | 9.29 | 8.8 | 8.68 | 8.84 | 9.64 | 8.42 | 7.75 | 9.39 | 8.29 | 8.83 | 7.91 | 7.52 | 7.21 | 7.07 |
| Water evap. per lb. coal, exclusive of lighting up, lbs. | 10.0 | 9.64 | 9.18 | 9.25 | 9.0 | 10.08 | 9.54 | 8.1 | 9.84 | 8.6 | 9.2 | 8.2 | 7.7 | 7.47 | 7.3 |
| Water evap. per lb. coal, from feed temperature, lbs. | 10.0 | 9.64 | 9.18 | 9.25 | 9.0 | 10.08 | 9.54 | 8.1 | 9.84 | 8.6 | 9.2 | 8.2 | 7.7 | 7.47 | 7.3 |
| Water evap. per lb. coal, equiv. from & at 212 deg., lbs. | 11.3 | 11.5 | 10.6 | 10.7 | 10.5 | 11.6 | 10.7 | 9.8 | 10.7 | 10.1 | 9.2 | 10.1 | 10.7 | 9.9 | 8.9 |

TABLE III.

| Time, Speeds, etc. | Yorkshire. A. | | | | | Welsh. B. | Lancashire. C. | | Cumberland. D. | | Scotch. E. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1. | 2. | 3. | 4. | 5. | 1. | 1. | 2. | 1. | 2. | 1. | 2. | 3. | 4. | 5. |
| Train miles | 112 | 112 | 112 | 112 | 112 | 112 | 112 | 112 | 112 | 112 | 112 | 112 | 112 | 112 | 112 |
| Engine miles | 120 | 120 | 120 | 120 | 120 | 120 | 120 | 120 | 120 | 120 | 120 | 120 | 120 | 120 | 120 |
| Maximum speed, miles per hour | 36.5 | 29 | 33.5 | 33.5 | 32 | 33 | 34 | 33 | 34.5 | 30 | 34 | 31 | 34 | 32 | 32 |
| Mean speed, exclusive of stops | 28.8 | 23 | 29.3 | 26.9 | 27.5 | 26.7 | 26.4 | 26.5 | 29.2 | 25.2 | 27.1 | 24.7 | 25.6 | 24.5 | 26.9 |
| Actual running time, minutes | 323 | 330 | 330 | 341 | 325 | 330 | 371 | 330 | 345 | 355 | 340 | 348 | 334 | 348 | 348 |
| Actual time (steam on), minutes | 279 | 286 | 286 | 297 | 281 | 286 | 327 | 286 | 301 | 311 | 296 | 304 | 290 | 304 | 304 |
| Time from lighting up to taking out fire, hours | 14.5 | 14 | 13.5 | 14 | 14.75 | 14.5 | 14.5 | 14.75 | 13.5 | 16.5 | 14.75 | 14.0 | 14 | 16.75 | 14.5 |
| Time standing between trips, minutes | 285 | 225 | 260 | 245 | 295 | 235 | 244 | 270 | 215 | 415 | 290 | 255 | 231 | 207 | 255 |

TABLE IV.

| Loads. | Yorkshire. A. | | | | | Welsh. B. | Lancashire. C. | | Cumberland. D. | | Scotch. E. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1. | 2. | 3. | 4. | 5. | 1. | 1. | 2. | 1. | 2. | 1. | 2. | 3. | 4. | 5. |
| Maximum pull on drawbar, lbs. | 10,200 | 9,600 | 10,200 | 10,200 | 9,600 | 9,000 | 9,900 | 9,300 | 10,200 | 10,200 | 10,200 | 10,200 | 9,300 | 9,300 | 10,200 |
| Mean pull on drawbar, lbs. | 4,860 | 4,830 | 4,837 | 4,740 | 4,950 | 4,740 | 4,950 | 4,620 | 4,545 | 5,475 | 4,809 | 5,160 | 4,854 | 4,710 | 4,800 |
| Maximum load, tons | 557 | 507 | 565 | 515 | 512 | 572 | 520 | 605 | 550 | 568 | 573 | 590 | 574 | 545 | 572 |
| Mean load, tons | 361 | 329 | 424 | 369 | 340 | 371 | 375 | 391 | 352 | 378 | 369 | 407 | 405 | 332 | 418 |
| Maximum number of vehicles | 50 | 54 | 50 | 50 | 49 | 53 | 54 | 54 | 52 | 52 | 51 | 52 | 46 | 49 | 52 |
| Mean number of vehicles | 45 | 37 | 41.7 | 47 | 43.7 | 42.5 | 48.1 | 41.5 | 39.5 | 44.6 | 41.2 | 45.9 | 43.6 | 37 | 47.2 |
| Maximum indicated horse-power | 764.4 | 640 | 656 | 753.6 | 696 | 652.8 | 676 | 668 | 750 | 728 | 684 | 788 | 820 | 536 | 684 |
| Mean indicated horse-power | 505 | 460 | 480 | 445 | 500 | 497 | 462 | 460 | 432 | 518 | 458 | 478 | 489 | 448 | 444 |
| Maximum number wagon journals | 200 | 216 | 200 | 200 | 196 | 212 | 216 | 216 | 208 | 208 | 204 | 208 | 184 | 196 | 208 |
| Mean number wagon journals | 180 | 148 | 164 | 188 | 174 | 170 | 192 | 166 | 158 | 178 | 164 | 183 | 174 | 148 | 188 |

TABLE V.

| Temperatures, Vacuums, etc. | Yorkshire. A. | | | | | Welsh. B. | Lancashire. C. | | Cumberland. D. | | Scotch. E. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1. | 2. | 3. | 4. | 5. | 1. | 1. | 2. | 1. | 2. | 1. | 2. | 3. | 4. | 5. |
| Temp. of water in boiler at time of light'g up, deg. F. | 210 | 80 | 210 | 210 | 200 | 210 | 209 | 210 | 209 | 210 | 195 | 200 | 198 | 210 | 210 |
| Maximum vacuum in smoke-box, in. | 2.75 | 3.5 | 3.5 | 4.0 | 4.0 | 3.0 | 3.5 | 2.75 | 4.0 | 4.0 | 2.5 | 3.0 | 3.0 | 2.8 | 2.5 |
| Mean vacuum in smoke-box, in. | 1.75 | 2.0 | 2.07 | 1.51 | 2.04 | 1.65 | 1.79 | 1.5 | 1.97 | 2.0 | 1.3 | 1.86 | 1.57 | 1.5 | 1.51 |
| Maximum temperature in smoke-box gases, deg. F. | 575 | 550 | 580 | 625 | 625 | 560 | 570 | 550 | 600 | 580 | 550 | 560 | 550 | 530 | 550 |
| Mean temperature in smoke-box gases, deg. F. | 499.2 | 490 | 505 | 501 | 530 | 489.5 | 509 | 508 | 520 | 503 | 486 | 493 | 505 | 501 | 515 |
| Maximum pressure through fire-hole, in. | 1.1 | 1.3 | 1.1 | 1.1 | 1.1 | 1.0 | 1.6 | 1.2 | 1.2 | 1.2 | 0.9 | 0.8 | 0.9 | 0.85 | 0.9 |
| Mean pressure through fire-hole, in. | 0.70 | 0.61 | 0.65 | 0.62 | 0.65 | 0.96 | 0.75 | 0.75 | 0.6 | 0.6 | 0.8 | 0.6 | 0.74 | 0.65 | 0.5 |
| Maximum speed through ash pan, in. | 0.1 | 0.15 | 0.10 | 0.15 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.05 | 0.10 | 0.16 | 0.10 | 0.10 | 0.05 |
| Mean pressure through ash pan, in. | 0.1 | 0.05 | 0.06 | 0.06 | 0.06 | 0.10 | 0.07 | 0.06 | 0.065 | 0.05 | 0.075 | 0.07 | 0.08 | 0.07 | 0.05 |

TABLE VI.

| Relative Consumption of Coal. | Yorkshire. A. | | | | | Welsh. B. | Lancashire. C. | | Cumberland. D. | | Scotch. E. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1. | 2. | 3. | 4. | 5. | 1. | 1. | 2. | 1. | 2. | 1. | 2. | 3. | 4. | 5. |
| Based on pull of drawbar | 1.000 | 1.058 | 1.118 | 1.120 | 1.125 | 1.045 | 1.096 | 1.233 | 1.054 | 1.174 | 1.086 | 1.211 | 1.272 | 1.310 | 1.398 |
| Based on indicated horse-power | 1.000 | 1.113 | 1.137 | 1.128 | 1.147 | 1.014 | 1.083 | 1.251 | 1.064 | 1.167 | 1.113 | 1.231 | 1.256 | 1.289 | 1.389 |
| Based on ton mileage | 1.000 | 1.147 | 0.965 | 1.060 | 1.234 | 1.017 | 1.095 | 1.104 | 1.006 | 1.286 | 1.069 | 1.163 | 1.156 | 1.400 | 1.217 |
| Based on calorimeter tests | 1.000 | 1.015 | 1.074 | 1.043 | 1.074 | 1.003 | 1.064 | 1.147 | 1.064 | 1.114 | 1.126 | 1.125 | 1.070 | 1.138 | 1.229 |

Relative consumption × by cost of coal per ton D/d = relative value.

TABLE VII.

| Efficiencies. | Yorkshire. A. | | | | | Welsh. B. | Lancashire. C. | | Cumberland. D. | | Scotch. E. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1. | 2. | 3. | 4. | 5. | 1. | 1. | 2. | 1. | 2. | 1. | 2. | 3. | 4. | 5. |
| Efficiency of engine, per cent. | 10.8 | 10.7 | 10.0 | 10.3 | 10.4 | 10.5 | 11.0 | 10.7 | 10.3 | 11.4 | 10.6 | 10.7 | 11.1 | 11.3 | 10.4 |
| Efficiency of boiler, per cent. | 78.0 | 75.9 | 77.1 | 74.2 | 77.5 | 79.0 | 73.0 | 72.5 | 80.1 | 75.2 | 80.7 | 71.7 | 65.7 | 66.9 | 71.7 |
| Efficiency of engine and boiler combined, per cent. | 8.4 | 8.1 | 7.7 | 7.6 | 8.0 | 8.2 | 8.0 | 7.7 | 8.2 | 8.5 | 8.4 | 7.6 | 7.2 | 7.5 | 7.3 |
| Heat carried away by products of combustion, B.T.U. | 2,458 | 2,406 | 2,491 | 2,468 | 2,633 | 2,403 | 2,514 | 2,451 | 2,576 | 2,479 | 2,383 | 2,432 | 2,491 | 2,468 | 2,548 |
| Heat expended in evaporating the water, B.T.U. | 11,126 | 10,713 | 10,240 | 10,101 | 10,287 | 11,227 | 9,804 | 9,015 | 10,923 | 9,647 | 10,275 | 9,204 | 8,748 | 8,387 | 8,223 |
| Heat lost by radiation, imperfect combus., etc., B.T.U. | 663 | 919 | 524 | 849 | 337 | 570 | 1,093 | 953 | .... | 651 | .... | 1,035 | 2,071 | 1,675 | 802 |
| Heat turned into work, per minute, B.T.U. | 21,588 | 19,665 | 20,520 | 19,023 | 21,375 | 21,246 | 19,750 | 19,665 | 18,468 | 22,144 | 19,579 | 20,434 | 20,904 | 19,152 | 18,981 |
| Heat taken up by feed water, per minute, B.T.U. | 198,853 | 195,200 | 197,050 | 184,352 | 205,390 | 201,425 | 177,944 | 183,540 | 178,400 | 194,106 | 184,400 | 189,361 | 188,297 | 170,918 | 182,289 |

fast freight from Barrow Yard to Carnforth, a distance of 28 miles, in a schedule time of 50 minutes without stops. On the return trip one stop was made and a helper was used on one grade of 1 in 76 for a distance of 3½ miles. The schedule time returning was 110 minutes.

The engine has 18 in. x 26 in. cylinders placed outside the frames. The drivers are 56 in. in diameter and the total wheel base is 15 ft. The boiler contains 208—1¾ in. tubes 10 ft. 9¾ in. long. The tube heating surface is 1,029 sq. ft. and the fire-box heating surface is 105 sq. ft. The total weight of the engine is 85,400 lbs., and the tender weighs 63,200 lbs. The grate area is 20.5 sq. ft. and the working pressure is 150 lbs.

Taking the trial of Yorkshire coal No. 1, Table II., the consumption of water per hour with steam on was 10,258 miles per hour, the number of revolutions 132 per minute, and the boiler pressure 135 lbs. per sq. in.

The speeds given in Table III. were taken by a Boyer speed indicator and recorder, which was fixed to the platform on the front end of the engine, and coupled by means of a belt to a pulley fixed in the leading axle.

The maximum speed was 36½ miles per hour, during the trial of Yorkshire coal No. 1 on June 27, 1901, on the up journey from Barrow to Carnforth (second round) on an up gradient of 1 in 530. The load hauled, excluding engine and tender, was 284 tons, the number of cars 45, and the number of revolutions 219, the indicated horse-power developed being 441.

The loads on each trip were carefully noted. The maximum load, given in Table IV., on any one trip was show it to be a superior coal. Owing chiefly to these difficulties, the author designed a means of obtaining the pull on the drawbar, which is obtained through the medium of a hydraulic cylinder fixed at the trailing end of the tender. The pull is recorded by means of a gage which is on the platform inside the cab of the engine, the gage reading up to a pressure of 600 lbs. and connected by a pipe leading from the cylinder, the pressure being in proportion to the pull. The cylinder in which the ram works, is securely bolted to the underframe of the tender, and the space at the end of the cylinder filled with oil. The pressure is transmitted from the drawbar, through the medium of the oil in the cylinder, to the gage, the pressure being proportional to the pull on the drawbar. The ram is fitted with a leather cup on

the end. The diameter of the ram is 30 sq. in., so that this figure, multiplied by the pounds per square inch registered by the gage, gives the actual pull on the drawbar. During the trials the records were taken at one mile intervals. The maximum pull to start a train of 500 tons from rest was 12,000 to 18,000 lbs., and the maximum pull registered while running was 10,200 lbs. during the trial of Cumberland coal No. 1 on July 2, while hauling a train of 49 cars, at a speed of 22 miles per hour, up a gradient of 1 in 63. A diagram taken at the time gave 730 i.h.p.

On reference to Table I., the coal consumption for the various kinds of coal are given in pounds per pound pull on drawbar per mile, also per hour. The mean consumption during the trial of Yorkshire coal No. 1 was 0.0087 lbs., which was obtained by dividing the consumption per train mile exclusive of lighting up—for which 2 cwt. is deducted—by the average pull recorded throughout the trial on the drawbar in pounds per mile. The calorific value of samples of each kind of coal was taken from bulk with a Thompson's calorimeter, several tests being made from one sample, the mean being taken in each case.

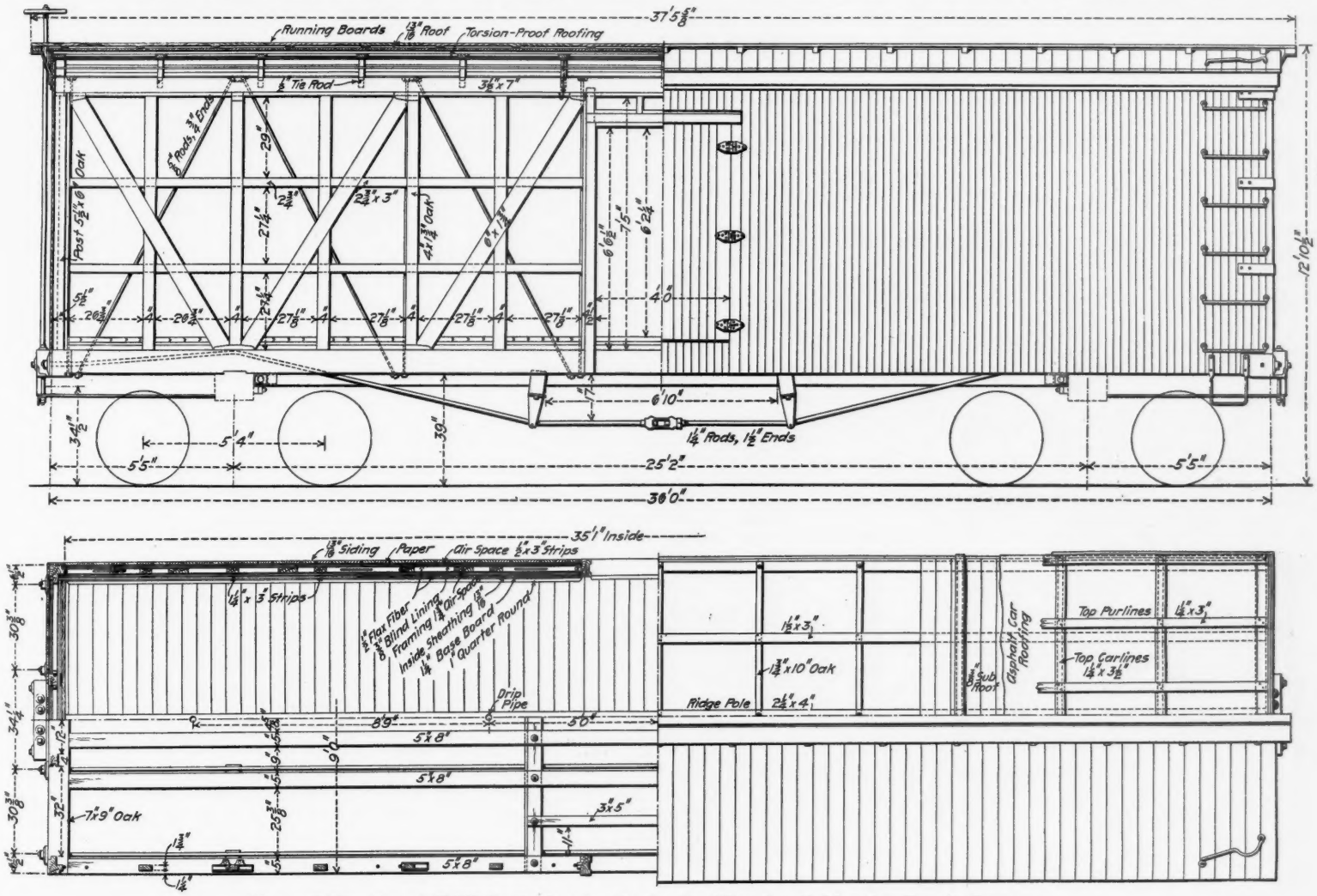
The various samples of coal were thoroughly tested, the consumption per train mile, per horse-power per hour, per ton mile, and per drawbar mile, being obtained from these results. The relative consumption of each kind was obtained as follows: The best result, that is to say the lowest consumption in pounds per pound pull on drawbar, was taken as 1.000, as shown in Table VI., and each result was recorded in its relative proportion. The highest consumption was the Scotch coal No. 5, with a relative consumption of 1.398, which means that 39.8 per cent. more coal would be used in doing the same work as done by the Yorkshire coal No. 1. The relative consumption based on the indicated horse-power and ton mileage was worked out in the same manner, and serves as a check to the results obtained.

It is important to take into consideration the steaming qualities, the percentage of ash, and type of clinker, as a bad steaming coal which forms a thin clinker over the bars is very troublesome in locomotives, and might cause serious delays to traffic owing to shortness of steam. It is also necessary that the fire should not require cleaning during the day.

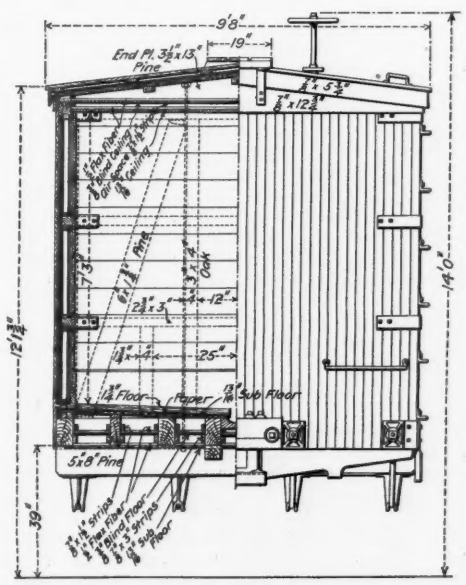
The next question is one of cost, which is the most important item. Owing to the distance from the coal fields, it does not follow that the coal which gives the best results in steaming and lowest consumption is the cheapest. The method adopted by the author, however, is seen by referring to the relative consumption table (Table VI.), from which the relative value of any coal which has been tested can be easily obtained. For example, suppose the cost of Yorkshire No. 1 be taken at 14s. per ton delivered, this multiplied by 1.000, as given in the relative consumption column, would equal 14s. Now if we take, say, Lancashire No. 1 at 11s. per ton delivered, this multiplied by 1.096, as given in the relative consumption column, the relative cost would be 12s. 0.67d. per ton. It would therefore be cheaper to use this coal, although the consumption per mile would be much consumption can be obtained of any coal which has been higher. It will therefore be seen the relative cost as per once tested. The efficiency of the engine and boiler are given on Table VII.

## New Cars for the Milwaukee Refrigerator Transit Company.

The Milwaukee Refrigerator Transit Company is having 340, 36-ft., 60,000-lb. refrigerator cars built by the Pullman Company. These cars will be used for carrying beer and are intended for the service of the Pabst Brewing Company, Milwaukee. All details of interest are clearly shown in the drawings. The cars will have cast-steel body and truck bolsters, furnished by the American Steel Foundries, and will be mounted on Barber trucks.




Plan and Elevation of 60,000-lb. Refrigerator Car for the Milwaukee Refrigerator Transit Company.




End Elevation and Cross-Section.

The underframe is wood, but the draft sills will be 8-in., 23-lb. I-beams, bolted to the center sills above by four 1-in. bolts running through their flanges just outside of the web. These draft sills abut the body bolster at the rear and are tied to it by two 1½-in. strap bolts, riveted to the web of the I-beam, one above the other, 3¾-in. centers, with five ¾-in. rivets. They pass through specially cored holes in the bolster and are secured at the back with double nuts and cotters. Dayton twin-spring gear is used.

## The Anti-Injunction Bill.

The anti-injunction bill now pending at Washington is being mightily pressed for adoption by the labor unionists, and mightily opposed by employers. It is a faulty and mischievous measure as it stands, in that it forbids the use of restraining orders from a federal court of equity in relation to a trade dispute. This is special legislation; a wrongful use of equity in any other case is as important as a wrongful use in strike cases. But whither are we drifting in this matter of the injunction? Chancery jurisdiction has always heretofore been regarded with jealous eyes in societies where free political institutions have obtained any foothold. At the time of the adoption of the act creating the judiciary in the first Congress of the United States, there were lawyers who contended that equity powers should not be conferred at all upon the federal courts. To guard against the dangers of abuse of such powers the legislature of Virginia provided for trial by jury in all matters of fact in chancery jurisdiction. Jefferson was opposed to the union of law and equity in the same courts, as we have it in the federal and in most of the state tribunals. He said:

> Relieve the judges from the rigor of text laws, and permit them, with pretorian discretion, to wander into its equity, and the whole legal system becomes uncertain. This has been its fate in every country where the fixed and the discretionary law have been committed into the same hands.

Where both powers are vested in the same court we have a positive influence tending to set up equity action at the expense of action at law, since all men love power, and judges are no exception. Injunctions to enforce law and injunctions to make law have continued to issue with increasing frequency, and now the demand for restraining legislation simmers down largely to the union labor crowd exclusively, and there takes the form of a demand for special restraint in the interest of a particular class. The will of the judge, as Bacon said, has now come to master the law, and the influential classes of the country would evidently have it so as a permanency.

This is all disturbingly significant—of a disposition among the property interests of the country to favor the creation of despotic power in government. James M. Beck, a former Assistant Attorney-General of the United States, representing various business organizations before the House Judiciary Committee, said, the other day:

> At common law strikers who thus by violence interfere with the rights of others may be indicted for criminal conspiracy. But is it more humane to indict, convict, and imprison them than to merely stay their hands?

It is admitted that equity is being employed, not to remedy where the law affords no remedy, but in the revolutionary manner of taking into its own absolute dis-

cretion cases covered by the law. That this is a most dangerous symptom for free institutions we need not say. It is an admission or a contention that democracy and government by law are no more to be trusted, and that our influential classes are beginning to sigh for the strong man and a despotic order of government.—*Springfield Republican.*

### C. K. Jones's Automatic Telegraph Circuit Protector.

The Illinois Central now has in use between Kensington, Ill., and Champaign, and between Gilman and Clinton, 28 of C. K. Jones's clock arrangements for cutting out a telegraph key in case it is left open more than a given time, and for ringing a bell to call the attention of the operator to his negligence. This device was described in the *Railroad Gazette* of July 3, 1903. The Illinois Central has it in use at telegraph offices with which the despatcher is likely to have to communicate on short notice to send train orders, and the despatchers who work the wires to these stations report marked satisfaction with the service of the machines. The arrangement consists of an electro-magnet, with circuit closers, attached to a clock, in such a way that if the line is open for a certain time (in this case 90 seconds) the key at that station will be cut out and the ground wire cut off. When the line is opened or the ground wire is put on, the minute hand of the clock begins to move and at the end of 90 seconds it closes in a local circuit, ringing the bell; it makes a bridge for the main line around the key, and it cuts off the ground wire. If the despatcher wishes to arouse an operator at Station B (between A and C) who may be asleep or out of hearing of his sounder, he orders the ground wires connected for 90 seconds at A and at C. This, of course, opens the main line at B by cutting it off from the main batteries, and when the time expires the bell at B beings to ring. It rings until the operator is aroused and shuts off its current.

Mr. Jones, whose present address is Quincy, Ill., has received a number of commendatory letters from Illinois Central despatchers. One of these letters says:

The automatic circuit protector and signaling machines have at all times performed the service expected of them. Last night I had called a station for 10 minutes and had come to the conclusion that the operator was asleep. (He afterwards admitted to me that such was the case.) I only had three or four minutes left to catch a manifest train to give it help against a stock train which had fallen down. I directed the offices north and south of him to ground the wire for 90 seconds, to cut off the main battery from the office wanted and thus ring his bell. During this interval I was able to put out a running order for another train, and when the time was up my man was there and reported the train coming. Without this machine there would have been a bad delay at a blind station. We now have no trouble with open keys and grounds; and where these faults do occur the machines close them quicker than we could get them closed with another wire.

Another despatcher says: We use the clock with great success. A few days ago we had considerable rain, wires were working heavy and operators were not adjusted. I wanted T. and R. to help two freight trains on a passenger train which had been delayed at the terminal, but could not raise either office. I had X ground the wire and open his key for 90 seconds to ring up T. and R. I went on with my work and in about two minutes I called both offices and both answered promptly; one was not adjusted and the other operator was out in the freight house; but both heard the bells and answered and saved an hour's delay to the two freight trains. The operator at F. left train wire open one day and went to dinner; the clock closed the circuit and saved a delay of over an hour. We have given this machine a thorough test, trying all schemes we could think of, but always found it there with the goods. A few days ago the day operator at D left the office about 5 o'clock p. m., and I spent considerable time trying to raise him. Finally I used the bell and the yardmaster 'phoned the downtown office to tell me there was no operator there; he heard the bell and knew we wanted the office.

The chief despatcher says that since the machines have been put in on the Chicago District complaints of despatchers as to inability to raise operators have decreased at least 75 per cent.

### Protection From Ice and Flood.

Webutuck Creek leads down from the Berkshire Hills and meets the Harlem division of the New York Central at nearly a right angle; then it turns squarely south and runs parallel with the line. This is at Wassaic, 82 miles north of New York. It is a mountain stream, with still-waters where in severe winters thick ice forms and when this breaks suddenly after heavy rains in February, great masses of ice jam and pile up in a gorge near the track. When the ice jam moves again, as it did three years ago, the railroad bank is cut and the highway bridges are carried away. This year, after about two months of zero weather, the conditions were ripe for damage.

Protection From Ice and Flood.

It had been observed in previous years that the flood, coming from this mountain stream, passed quickly, and this suggested the idea that if the heavy ice fields could be held back temporarily, in such a way as to not materially obstruct the water flow, the danger could be lessened. This was accomplished by the heavy gridiron, shown in the photograph. When the flood came on February 22, it seemed to be the worst ever known, but the ice piled up 30 feet high on the gridiron, and the great sheets pushed over at this height fell and broke to harmless sizes. Meantime the water, somewhat detained, but not dangerously held, prolonged the time of the flood and made it not at all dangerous.

The photograph is taken from the up-stream side and shows the frame standing at about 30 deg. from the vertical and leaning down stream. The lower beam is set 9 ft. above the bed of the stream. The beams are each 50 ft. long, 12 in. x 16 in., framed 3 ft. apart. Additional height was made with three red oak trees of about 15 in. butts. Three 30-ft. railroad rails were fastened with U-bolts to the beams, and reached down to the bed of the stream. Probably these rails were added in order to make the ice tend to climb, and not to jam in between the beams. The photograph, taken after the flood, shows that two of the rails were broken at the lower ends, and one of these, after breaking slid down.

The toe-hold for the beams was easy. The rock wall at each side is vertical, and in it 1¼-in. holes were drilled 10 in. deep. Heavy timbers were bolted so as to form a butment cheek for the horizontal beams.

The cost of this preventive measure was absurdly small in comparison with the loss avoided. The railroad company furnished the beams, rails and scrap iron, and loaned rope and tackle. Others interested did the work at a cost of $122. Incidentally, a highly desirable public sentiment toward the railroad results from this working together.

### A Study in Piece Work.*

Up to the spring of the year 1899, all of the materials in the yard of the Bethlehem Steel Company have been handled by gangs of men working by the day, and under the foremanship of men who had formerly worked as laborers. All the men were paid the ruling wages of laborers in that section of the country, namely, $1.15 per day, the only means of encouraging or disciplining them being either talking to them or discharging them. Occasionally, however, a man was selected from among these men and given a better class of work with slightly higher wages in some of the companies' shops, and this had the effect of slightly stimulating them. From four to six hundred men were employed at this work.

The work of these men consisted mainly of unloading from cars and shoveling on to piles, and from these piles again loading as required, the raw materials used in running three blast furnaces and seven large open-hearth furnaces. The material handled was ore of various kinds, varying from fine, gravelly ore to that which comes in large lumps, coke, limestone, special pig, sand, etc., unloading hard and soft coal for boilers, gas-producers, etc., and also for storage and again loading the stored coal as required for use, loading the pig iron produced at the furnaces both for shipment, for storage, and for local use, and handling billets, etc., produced by the rolling mills. It was not usual for a man to be kept continuously at the same class of work.

Before undertaking the management of these men, the writer was informed that they were steady workers, but slow and phlegmatic, and that nothing would induce them to work fast. His first step was to place an intelligent, college-educated man in charge of progress in this line. This man had not before handled this class of labor, although he understood managing workmen. He was not familiar with the methods pursued by the writer, but was soon taught the art of determining how much work a first-class man can do in a day. This was done by timing with a stop watch a first-class man while he was working fast. The best way to do this, in fact almost the only way in which the timing can be done with certainty, is to divide the man's work into its elements and time each element separately. For example, in the case of a man loading pig iron on to a car, the elements should be: Picking up the pig from the ground or pile (time in hundredths of a minute). Walking with it on a level (time per foot walked). Walking with it up an incline to car (time per foot walked). Throwing the pig down (time in hundredths of a minute), or laying it on a pile (time in hundredths of a minute). Walking back empty to get a load (time per foot walked).

In case of important elements which were to enter into a number of rates, a large number of observations were taken when practicable on different first-class men, and at different times, and the results were averaged. The most difficult elements to time are the percentage of the day required for rest, and the time to allow for accidental or unavoidable delays.

In the case of the yard labor at Bethlehem, each class of work was studied as above, each element being timed separately, and in addition, a record was kept in many cases of the total amount of work done by the man in a day. The record of the gross work of the man (who is being timed) is, in most cases, not necessary after the observer is skilled in his work. As the Bethlehem time observer was new to this work, the gross time was useful in checking his detailed observations and so gradually educating him and giving him confidence in the new methods. The writer had so many other duties that his personal help was confined to teaching the proper methods and approving the details of the various changes which were in all cases outlined in written reports before being carried out.

As soon as a careful study had been made of the time elements entering into one class of work, a single first-class workman was picked out and started on ordinary piece work on this job. His task required him to do between 3½ and 4 times as much work in a day as had been done in the past, on an average. Between 12 and 13 tons of pig iron per man had been carried from a pile on the ground, up an inclined plank, and loaded on to a gondola car by the average pig iron handler while working by the day. The men in doing this work had worked in gangs of from five to 20 men. The man selected from one of these gangs to make the start was called upon to load on piece work from 45 to 48 tons (2,240 lbs. each) per day. He regarded this task as an entirely fair one, and earned on an average, from the start, $1.85 per day, which was 60 per cent. more than he had been paid by the day. This man happened to be considerably lighter than the average good workman at this class of work. He weighed about 130 lbs. He proved, however, to be especially well suited to this job, and was kept at it steadily throughout the time that the writer was in Bethlehem, and I believe is still at the same work.

Being the first piece work started in the works, it excited considerable opposition, both on the part of the workmen and on the part of several of the leading men in the town, their opposition being based mainly on the old fallacy that if piece work proved successful, a great many men would be thrown out of work, and that thereby not only the workmen, but the whole town would suffer. One after another of the new men who were started singly on this job were either persuaded or intimidated

*Extract from a paper by Mr. F. W. Taylor, on "Shop Management." See Transactions of the American Society of Mechanical Engineers, Vol. XXIV, 1903.

into giving it up. In many cases they were given other work by those interested in preventing piece work, at wages higher than the ruling wages. In the meantime, however, the first man who started on the work earned steadily $1.85 per day, and this object lesson gradually wore out the concerted opposition, which ceased rather suddenly after about 2½ months. From this time on there was no difficulty in getting plenty of good men who were anxious to start on piece work, and the difficulty lay in making with sufficient rapidity the accurate time study of the elements or "unit times" which forms the foundation of this kind of piece work.

During the introduction of piece work, and after a thorough time study of a new section of the work was started, one man only was put on each new job, and not more than one man was allowed to work at it until he had demonstrated that the task set was a fair one by earning an average of $1.85 per day. After a few sections of the work had been started in this way, the complaint on the part of the better workmen was that they were not allowed to go on to piece work fast enough. It required about two years to transfer practically all of the yard labor from day to piece work. And the larger part of the transfer was made during the last six months of this time. As stated above, the greater part of the time was taken up in studying "unit times," and this time study was greatly delayed by having successively the two leading men who had been trained to the work leave because they were offered much larger salaries elsewhere. The study of "unit times" for the yard labor took practically the time of two trained men for two years. Throughout this time the day and piece workers were under entirely separate and distinct management. The original foremen continued to manage the day work, and day and piece workers were never allowed to work together. Gradually the day work gang was diminished, and the piece workers were increased as one section of work after another was transformed from the former to the latter.

Two elements which were important to the success of this work should be noted: First, on the morning following each day's work, each workman was given a slip of paper informing him in detail just how much work he had done the day before, and the amount he had earned. Thus enabling him to measure his performance against his earnings while the details were fresh in his mind. Without this there would have been great dissatisfaction among those who failed to accomplish the task asked of them, and many would have gradually fallen off in their performance. Second, whenever it was practicable, each man's work was measured by itself. Only when absolutely necessary was the work of two men measured up together, and the price divided between them, and then care was taken to select two men having as nearly as possible the same capacity. Only on few occasions, and then upon special permission signed by the writer, were more than two men allowed to work on gang work, dividing their earnings between them. Gang work almost invariably results in a falling off in earnings and consequent dissatisfaction.

An interesting illustration of the desirability of individual piece work instead of gang work came to our attention at Bethlehem. Several of the best piece workers among the Bethlehem yard laborers were informed by their friends that a much higher price per ton was paid for shoveling ore in another works. After talking the matter over with the writer he advised them to go to the other works, which they accordingly did. In about a month they were all back at work in Bethlehem again, having found that at the other works they were obliged to work with a gang of men instead of on individual piece work, and that the rest of the gang worked so slowly that in spite of the high price paid per ton they earned much less than at Bethlehem.

The following table gives a summary of the work done by the piece work laborers in handling raw materials, such as ores, anthracite and bituminous coal, coke, pig iron, sand, limestone, cinder, scale, ashes, etc., in the works of the Bethlehem Steel Company, during the year ending April 30, 1901. This work consisted mainly in loading and unloading cars on arrival or departure from the works, and for local transportation, and was done entirely by hand, *i.e.*, without the use of cranes or other machinery.

| | Piece work. | Day work. |
|---|---|---|
| Number of tons (2,240 lbs.) handled on piece work during the year ending April 30, 1901 | 924,040 13/100 | ..... |
| Total cost* of handling 924,040 13/100 tons, including the piece work wages paid the men, and in addition all incidental day labor used | $30,797.78 | ..... |
| Former cost of handling the same number of tons of similar materials on day work | ..... | $67,215.47 |
| Net saving in handling 924,040 13/100 tons of materials, effected in one year through substituting piece work for day work | 36,417.69 | ..... |
| Average cost for handling a ton (2,240 lbs.) on piece and day work | 0.033 | 0.072 |
| Av'ge earnings per day, per man | *1.88 | 1.15 |
| Average number of tons handled per day per man | 57 | 16 |

*The piece workers handled on an average 3.56 times as many tons per man per day as the day workers. It was our intention to fix piece work rates which should enable first-class workmen to average about 60 per cent. more than they had been earing on day work, namely, $1.85 per day. A year's average shows them to have earned $1.88 per day, or 3 cents per man per day more than we expected. An error of 1.6 per cent.

It was clearly understood by each newcomer that, unless he was able to average at least $1.85 per day, he would have to make way for another man. As a result, first-class men from all over that part of the country, who were in most cases earning from $1.05 to $1.15 per day, were anxious to try their hands at earning $1.85 per day. If they succeeded they were naturally contented, and if they failed they left, sorry that they were unable to maintain the proper pace, but with no hard feelings either toward the system or the management. Throughout the time that the writer was there, labor was as scarce and as difficult to get as it ever has been in the history of this country, and yet there was always a surplus of first-class men ready to leave other jobs and try their hand at Bethlehem piece work.

Perhaps the most notable difference between these men and ordinary piece workers lay in their changed mental attitude toward their employers and their work, and in the total absence of soldiering on their part. The ordinary piece worker would have spent a considerable part of his time in deciding just how much his employer would allow him to earn without cutting prices and in then trying to come as close as possible to this figure, while carefully guarding each job so as to keep the management from finding out how fast it really could be done. These men, however, were faced with a new but very simple and straightforward proposition, namely, am I a first-class laborer or not? Each man felt that if he belonged in the first class all he had to do was to work at his best, and he would be paid 60 per cent. more than he had been paid in the past. Each new piece work price was accepted by the men without question. They never bargained over nor complained about rates, and there was no occasion to do so, since they were all equally fair, and called for almost exactly the same amount of work and fatigue per dollar of wages. A careful inquiry into the condition of these men when away from work developed the fact that out of the whole gang, only two were said to be drinking men. This does not, of course, imply that many of them did not take an occasional drink. The fact is that a steady drinker would find it almost impossible to keep up with the pace which was set, so that they were practically all sober. Many if not most of them were saving money, and they all lived better than they had before.

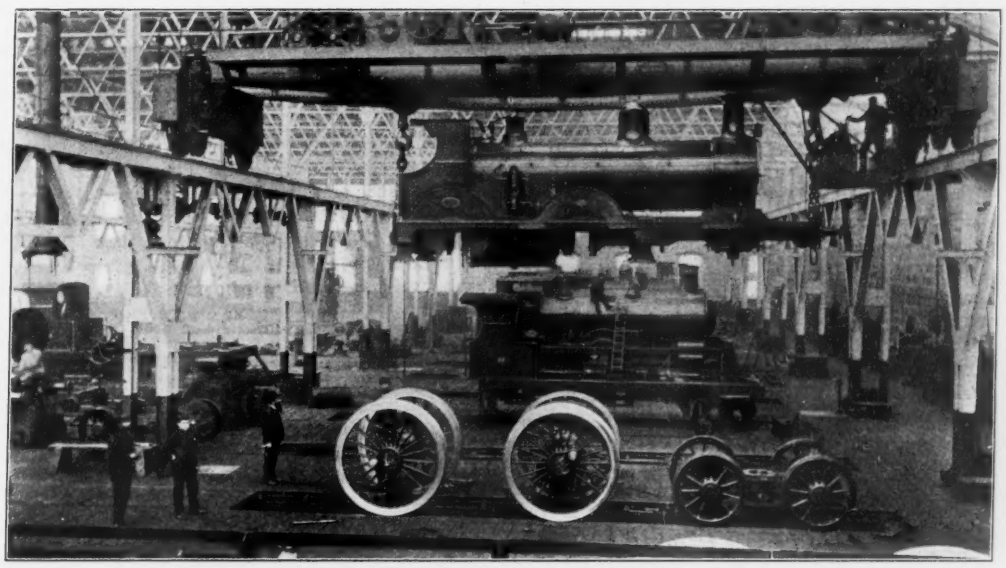
This system virtually establishes a labor union of first-class men, who are united to secure the extra high wages. Such a union commands the unqualified admiration and respect of all classes of the community; the respect equally of workmen, employers, political economists, and philanthropists. There are no dues for membership, since all of the expenses are paid by the company. The employers act as the officers of the union, to enforce its rules and keep its records, since the interests of the company are identical and bound up with those of the men. It is never necessary to plead with, or persuade men to join this union, since the employers themselves organize it free of cost; the best workmen in the community are always anxious to belong to it. The feature most to be regretted about it is that the membership is limited. The words "labor union" are, however, unfortunately so closely associated in the minds of most people with the idea of disagreement and strife between the employers and men, that it seems almost incongruous to apply them to this case. Is not this, however, the ideal "labor union," with character and special ability of a high order as the only qualifications for membership.

It is a curious fact that with the people to whom the writer has described this system, the first feeling, particularly among those more philanthropically inclined, is one of pity for the inferior workmen who lost their jobs in order to make way for the first-class men. This sympathy is entirely misplaced. There was such a demand for labor at the time, that no workman was obliged to be out of work for more than a day or two, and so the poor workmen were practically as well off as ever. The feeling, instead of being one of pity for the inferior workmen, should be one of congratulation and rejoicing that many first-class men—who through unfortunate circumstances had never had the opportunity of proving their worth—at last were given the chance to earn high wages and become prosperous. This whole system rests upon an accurate and scientific study of "unit times," which is by far the most important element in modern management. With it, greater and more permanent results can be attained even under ordinary day work or piece work than can be reached under any of the more elaborate systems without it.

## Traversing Cranes in Locomotive Erecting Shops.

In connection with the introduction in locomotive shops, in recent years, of heavy overhead traversing cranes for handling locomotives in cross-track erecting shops, carrying them sideways the length of the shop over other engines standing on the pits, it may prove interesting to call attention to the fact that this system was introduced about 1890 in the locomotive shops of the Great North of Scotland Railway at Inverurie, Scotland. The illustration shows the interior of erecting shop No. 2, with a double-crab 60-ton electric crane handling an engine. There are three such erecting shops similarly equipped. Boilers are handled in the boiler shop by a 15-ton overhead electric crane. The pits in the buildings run in the same direction as the yard tracks, so that engines enter the house without having to pass over a turntable.

This system of handling engines in cross locomotive erecting shops by overhead cranes in place of transfer tables was introduced in this country by the Baldwin Locomotive Works, Philadelphia, about 1890, and a few years later by the Brooks Locomotive Works, Dunkirk, N. Y. Since 1900 the system has been installed by the Richmond Locomotive Works, Richmond, Va.; the Rogers Locomotive Works, Paterson, N. J.; the Lake Shore & Michigan Southern at its shops at Collinwood, O.: the Philadelphia & Reading at its shops at Reading, Pa., and by the Pittsburg & Lake Erie at its shops at McKee's Rocks, Pa. The Lehigh Valley is now building a large shop on the same system at Sayre, Pa.



Erecting Shop, Inverurie Shops, Great North of Scotland.

## Foreign Railroad Notes.

A correspondent writes from Corea to the Cologne *Gazette* that the manager of the railroad which the Japanese are building from Fusan (opposite a Japan port) to Seoul, 330 miles, took about 150 foreigners, including the members of the diplomatic corps, on an excursion over the 30 miles of the road completed out of Seoul, Oct. 20. The track is laid for about the same distance from the south end of the line, Fusan, where steamers lie at the station and transfer freight directly to the cars.

The Baden State Railroads no longer have a first class of passengers, except for trains that pass through countries, or "inter-state" travel, as we may call it. Only about one passenger out of 200 bought a first class ticket, and nine-tenths of the seats in first class cars were empty. Aside from express trains, not one in 700 passengers rode first class. The first class compartments have mostly been made second class for ladies exclusively. This proceeding seems likely to be imitated in other German States.

The Prussian State Railroads have received the 24 express and passenger locomotives ordered last spring, built to use superheated steam, and they have been apportioned among four different railroad directories, with instructions to record with great care the results of their operation, especially as regards economy of fuel and cost of lubrication, noting that the lubricants necessary for superheated steam are much more costly than those used at ordinary temperatures and pressures. The Minister of Public Works promises to issue a detailed report on the aggregate results within three months. The new engines cost more than the compound locomotives whose place they take.

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## EDITORIAL ANNOUNCEMENTS.

*CONTRIBUTIONS.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

*ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

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The telegraph service of American railroads has deteriorated in the past ten years and is now inefficient and neglected; there is need of a school or schools to train operators for the railroad service, and better salaries should be paid. These are not our statements; they are the conclusions of Mr. J. C. Browne, and of a valued correspondent of the *Railroad Gazette*, whose letter is printed on the first page of this issue. While the first assertion is sweeping and not easily susceptible of proof, there is evidence enough that slovenly senders and bad penmen are too common, and that chief operators do not get the best service from the wires and other facilities at their disposal. The Interstate Commerce Commission has reported at least three collisions due to the omission of the word "second" or "2d" in reading a train order. "Second No. two" was written, but it was read "No. two." These particular errors may not have been due to bad penmanship, but they serve as proof of a fault. The reports have included other collisions due to blunders of operators too young and inexperienced; not all in sending or receiving, but in other work. Message work (not train-orders) of a low grade is tolerated because errors therein do not endanger life or property; but the same operators generally receive the train orders. General slovenliness, in ordinary messages, is a sure indication of specific bad habits in handling despatchers' messages. To depend on the vigilance of a competent despatcher as a safeguard against errors by a dozen incompetent station-operators may for years seem to answer, but it is an unreasonable burden on the despatcher, and the safeguard often breaks down. In discussions, much is said about the exacting nature of a despatcher's work and the need of favoring him; in practice we overwork him. Strict requirements of training and experience should govern the employment of despatchers; but often they do not. Many despatchers, otherwise qualified, lack the moral qualities for controlling 10 or 50 station-operators. Patience and discrimination is needed to hold themselves and their helpers down to good Morse sending, free from excessive speed. Of Mr. Browne's two suggestions, that to engage operators from among local residents is more practical than that of a large school. The chief part of the schooling is in the school of experience. The trouble is not in the kind of school, but in its quality. It increases the cost of the telegraph department to employ a thoroughly competent teacher at every tenth office, and to pay beginners board wages, while they are learning, but that is the only remedy in sight.

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Unfortunately, a good plan is not all that is necessary. Drawing good operators from places along the line is not easy. When an energetic young man is drawn as far as the local railroad station, it is not long before he himself does the drawing—or pushing—which takes him to some city. An officer of a road which employs many telegraph operators in signal towers said recently that it was impossible to get competent men for towers remote from large towns; and this is a road in the East, not in the West, where all kinds of good men are supposed to be scarce. This officer denied that his operators' wages were unreasonably low. To get operators for the cable station at Midway Island, in the Pacific Ocean, extraordinary wages are paid and time contracts signed. Perhaps time contracts could be used to advantage in country telegraph offices, although the scheme might suffer from the lack of a wide sea and government supervision to aid in enforcing the contract. The use of the block system simplifies operators' work, and lowers the standard of skill and intelligence required, so far as mere telegraphing is concerned—for errors in orders are less likely to cause collisions—but this does not materially lessen the need of a higher standard in the other branches of the work. With electric bells for block-signaling, and telephones for station-to-station communication, we could almost get along without telegraph operators, but this does not solve Mr. Browne's problem; it only shifts it. There is need of an improvement in the efficiency of station agents, way-bill clerks and the whole station service. The public is ready to warmly commend the railroad on which it shall first see a marked improvement in this particular. People appreciate accurate and courteous men at stations, but find them only at some stations.

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### Railroad Legislation and Trolley Legislation.

Beginning with the granger statutes of a third of a century ago and continuing down to the present time the tenor and drift of steam railroad legislation in the western states has been pretty severely restrictive of the steam railroad corporations and, in not a few cases, positively hostile. Regulation of local freights and fares, railroad commissions charged with the execution of mandatory laws, repeated controversies in legislatures and the courts, appeals, disputes, revised law-making to enforce or redress old statutes, questions of constitutionality state and federal—all these have been familiar terms in the polemics of western railroad operation for many years. Indeed the interstate commerce law and Sherman act may be regarded on the larger federal scale, as the expression of the same legislative feeling. A like sentiment has crept eastward and, as a single example, may be illustrated by the inability of the New York, New Haven & Hartford Company to secure from the last Connecticut legislature the modification of the car detention law of that State—and this notwithstanding the corporation had a strong equitable case.

When we turn to the sentiment of State legislatures toward street railways we find a vivid contrast. In general that sentiment has been not merely friendly but even too concessive. Exceptions can, of course, be found, such as the attitude of the legislature of Massachusetts on certain restrictive laws, and of western States on three cent fares enforced in certain cities, but they only emphasize the rule; and, when this kindly legislative spirit has been sustained by lobby forces, statutes have resulted which may fairly be described as flagrant. As extreme examples may be cited two statutes of the State of Rhode Island which are so abnormal in their relation to public interest as to deserve fuller exposition and analysis.

The first of these, as it appears in the Rhode Island sessions laws, was passed in the year 1898. It is a general law entitled an act "for the purpose of providing additional revenue for the state." It sets forth that in lieu of all other state taxes, street railway corporations, if they are paying eight per cent. dividends or less, shall pay a tax of one per cent. on gross earnings to the state; if paying more than eight per cent. dividends, then the tax shall be a sum equal to the excess of such dividend over eight per cent., but never less than one per cent. on gross earnings. The municipalities are allowed to retain certain limited existing rights of taxation, but cannot deprive the companies of any of their existing rights or privileges and, if the municipality orders certain changes in location it must grant the company privileges as nearly like as possible. Subject to approval of the railroad commissioner there is apparently unlimited power of capitalization. Finally comes the remarkable provision that if a street railway company assents to and accepts the act on or before Oct. 1, 1898, then "the provisions of this act shall be binding and of full force between the state and such assenting company and shall not be altered or amended without the assent of both parties." In other words the tax rate and the other privileges are made a formal and perpetual contract with the state and are thus entrenched behind the United States Constitution.

This remarkable measure reappears in still more amazing shape in a voluminous law, passed in 1902, which incorporates as a "holding" corporation the Rhode Island Company, which controls practically the whole street railway system of the state. The powers given in this act to the corporation are almost boundless. It appears to have practically unlimited opportunity for recapitalizing its properties; it can condemn, by arbitration, minority stock; and it can take over gas and lighting properties as well as street railways. The only restrictions on the corporation in the act are prohibition of increase of existing fares on acquired railways and an ascending scale of taxation up to two per cent. on gross earnings after the year 1905. And the hard and fast contract with the state provided for in the general law of 1898 is applied specifically, also, to the vast privileges recited through page after page of the special law.

The question naturally arises whether such an extraordinary statute, tested in the higher courts of law, would stand against public policy, original powers of amendment and repeal and the legislative right, for example, to destroy in an emergency the corporation which it has created. Incidentally such legislation throws a side light on a capitalization of almost $80,000 a mile on Rhode Island street railways as compared with $46,261 a mile in Massachusetts. But, passing by such matters, one comes to the broader subject of the divergency in many States of legislative temper toward the steam and electric roads, marked by a certain severity on the one hand and a liberality on the other verging, sometimes, as in the Rhode Island case, into sheer recklessness.

The fundamental fact underlying the situation is to some extent a sentimental one. The steam road has lost the charm of novelty and with the steady exhaustion of new territory to be exploited has become a prosaic fact in the eye of the ordinary legislator. Not so the electric railway. It has, as yet, hardly passed its first decade of practical operation. Its attraction of novelty is not yet outgrown. Considerable regions yet remain for its exploitation and beyond the urban or local systems still have the possibilities of long distance lines. To the law-maker from the farm the electric railway still spells in large letters a new era of prosperity for his agricultural region, quicker access to the cities and to markets. What wonder that, under such conditions, what may be called the electric *motif* pervades law-making bodies and that promoters, seeking large concessions, know how to use it? Join such a legislative temper with more questionable influences, and the combination becomes singularly powerful. It may be added that the new set of problems which electric railways have presented to state legislatures imply also a certain amount of time to elapse before the law-makers, even if both intelligent and honest, can solve them.

The forecast reveals both the picture and the situation. Not many years will pass before the novelty and charm of the electric railway will quite pass away and like the steam road it will become commonplace. Legislators will grow more familiar with its problems in their relations to public convenience and necessity. New ideas will come in as to the value of street railway franchises. The Man in the Street who makes his daily trips on the trolley car will also have his ideas on questions of operation and fares, and his exacting views will be reflected more or less in State legislation. He surely will, in the march of events, have to readjust his views to electric operation of present steam lines also. But whether or not that larger change comes he will certainly not have to wait long before he sees in State legislatures the present street railway favoritism, which so advantages the promoter, disappear, and the history of steam roads, in its bearings on law-making, probably repeat itself in the future annals of the trolley.

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The favors shown street railways at the expense of the steam roads is a matter of considerable concern also to English managements at the present time. The situation in England is aggravated by the prevalence of municipally operated tramways and by the large increases of the last few years in the tax ratings of the railroad companies. The increases in municipal tramways and in the tax rates have been going on simultaneously year by year while the tramways have attracted away more and more of the railroad suburban traffic. In the words of the Taff Vale Chairman, railroad directors have

as yet done little more than give expression to a "gentle murmur and a sigh." But the feeling is now general in English railroad circles that the situation has been strained to breaking point and that resistance must be offered. To this end a conference of general managers and solicitors is about to be held for the purpose of framing a bill to be introduced into Parliament to deal generally with the entire question of taxes payable by railroad authorities. Last half year the Lancashire & Yorkshire lost some $110,000 in receipts, traceable directly to tramway competition. Yet, out of the 320 townships through which its lines run, 153 have increased the rates. The increases cost the company nearly $100,000 a year, and the Chairman estimates the amount which the railroad now pays in taxes at nearly $5,000 a working day, while the Great Northern pays taxes aggregating $1,250,000 a year. It is generally considered that the increasing assessments have gone far beyond equity.

In the Newcastle suburban district last half year, where the North Eastern has electrified its lines, that company experienced a fall of 61 per cent. in its passenger traffic because of tramway competition. Lord Ridley, the Chairman, said he hoped that Parliament would be wise enough to pass legislation which would assess railroad property more fairly and that it was hard that the railroads should be mulcted in support of rival municipal tramways.

### The Cost of the Siberian Railroad.

A St. Petersburg newspaper has recently published a detailed statement of the expenditures on the Siberian Railroad and enterprises connected therewith. This it gives in connection with a report of the "Siberian Railroad Committee," which has had charge of the matter from the beginning, on the work accomplished during the past 10 years. It has been assumed by some journals which have published this newspaper's figures that they were taken from the official report, which we doubt. But at the present time they are interesting and doubtless represent correctly the expenditures on different parts of the system of nearly 6,000 miles which at present has to forward and support the Russian army in Manchuria.

This table is as follows:

| | Miles. | Cost. |
|---|---|---|
| West Siberian | 880 | $26,299,756 |
| Central Siberian | 1,137 | 52,219,035 |
| Tomsk Branch | 59 | 1,324,084 |
| Lake Baikal Branch | 42 | 1,631,980 |
| Lake Baikal Ferry | ... | 3,470,419 |
| Circum-Baikal | 163 | 27,594,073 |
| Trans-Baikal | 687 | 41,135,927 |
| Kaidolovo Branch | 215 | 16,241,993 |
| Nikolskoje Branch | 73 | 4,175,195 |
| Ussuri Railroad | 475 | 23,807,546 |
| Ekaterinburg-Chelyabinsk | 149 | 3,362,832 |
| Perm & Kotlas | 538 | 21,293,272 |
| Improvements of Siberian R. R. | ... | 48,534,360 |
| Amoor line (abandoned) | ... | 1,044,353 |
| Chinese Eastern | 1,576 | 130,441,275 |
| River improvements, steamboats, Vladivostok harbor | ... | 5,310,867 |
| Chinese Eastern—guarding line | ... | 23,821,078 |
| Loss by China revolt | ... | 36,019,735 |
| City and port of Dalny | ... | 9,699,600 |
| Pacific steamer lines | ... | 5,879,964 |
| Total | 5,994 | $483,827,062 |

The West and Central Siberian and the Lake Baikal branch, 2,059 miles, make the continuing line from Chelyabinsk to Lake Baikal, as actually worked; the Circum-Baikal Railroad will not be completed for a year, and not more than half of the enormous sum charged against it has been expended as yet. The ferry is 42 miles long. The Trans-Baikal section continues the continental line for 515 miles of its length, and what is here called the Kaidolovo branch is really the main line, continuing it to the border of Manchuria, where the Chinese Eastern gives the connection to Port Arthur and Vladivostok. The 687 miles of the Ekaterinburg & Chelyabinsk and Perm & Kotlas are not parts of the Siberian line, but in connection with an old railroad over the Urals give it an outlet towards Archangel.

The charges for guarding the Chinese line seem absurdly large. It is not believable that the "loss by the Chinese revolt" of 1900 was anything like 70,000,000 roubles. Taking the railroads by themselves and the ferry, which is an essential part, the cost here charged is $403,015,818 for the 5,994 miles, or $67,186 per mile. The Circum-Baikal, 163 miles, is estimated to cost more than the 880 miles of the West Siberian, though we have no means of knowing how much of the $48,500,000 expended for "improvements" have gone into the West Siberian. The Chinese Eastern cost $82,800 per mile, which would be increased to no less than $120,800 per mile if we include the cost of guarding and loss by Chinese revolt, which items will serve to swell the bill against China when she exercises her right to take over the road at the expiration of the concession, if it ever comes to that.

The following reply to a memorial from four of the principal commercial organizations of Philadelphia has been sent to the commercial organizations, signed jointly by Mr. Cassatt, Mr. Baer, Mr. Thomas and Mr. Murray, for the Pennsylvania, Philadelphia & Reading, Lehigh Valley and Baltimore & Ohio railroads respectively:

"We have received your memorial, and we heartily sympathize with you in the efforts that you are making to aid us in maintaining the existing differentials in favor of the port of Philadelphia. We are doing all in our power to maintain these differentials, but the whole subject has now reached a point when it will be necessary to seriously review the situation, and probably this can only be done, as you suggest, by a new arbitration on the lines of the arbitration of 1882, and the subsequent reference to the Interstate Commerce Commission of 1898, in which, after careful consideration, the conclusion reached was to reaffirm the decision made by the arbitration of 1882, but as in the decision of 1882 no special reference was made to ex-lake grain, the commission also considered it, and concluded its report as follows:

"'If, therefore, our decision with reference to the all-rail differentials is correct, it seems to follow all the more that the ex-lake differentials should not be disturbed by us.'

"You will recall that representatives of the different ports appeared before the commission in 1882, and each port presented its own case, the railroad companies furnishing them any data which was deemed essential. We suggest, therefore, that as this is a contention between ports, you promptly take initiative measures to secure a reference of this whole subject either to the Interstate Commerce Commission or to a new board of arbitration."

The most recent rate established on ex-lake wheat to Philadelphia is 1.8 cents a bushel, March 3. It will presumably be met by the New York lines. It is needless to say that New York interests are firmly opposed to any arbitration of the ex-lake rate, maintaining categorically that there has been no observed differential and shall be none. The New York commercial organizations show a willingness, however, to refer the general subject of grain rates from the West to the seaboard to arbitrators. There is occasionally a despondent note in the New York papers to the effect that any kind of arbitration will be pretty sure to give a permanent differential at least to Newport News, sufficient to send a large amount of grain to that port in preference to New York.

The Board of Directors of the Merchants' Association of New York recently authorized the President to appoint a committee of five to investigate the subject and take such action as may seem to them advisable to effect a reduction or removal of grain differentials. A committee consisting of Gustav H. Schwab, Chairman; John C. Eames, William R. Corwine, George F. Vietor and Clarence Whitman has been appointed.

The coroner's jury which inquired into the cause of the collision at East Paris, Mich., December 26, when 22 persons were killed, has found that the disaster was due to "the neglect of the Pere Marquette Railway system and incompetent operators in its employ." It appears that the fireman of train No. 5, which ran past the train-order signal at McCord, testified that the signal light was burning and that it indicated all-clear; and the engineman, who is still confined to the hospital, and whose testimony was taken there and read before the coroner and jury, made the same statement, adding that he clearly saw the agent sitting at his desk in the office. The fireman testified "in a straightforward manner and without wavering." The station agent at McCord testified that he had set the signal in the stop position, and, as was reported in the newspapers at the time, immediately after the passage of the train discovered that the signal light had been extinguished by the wind. The jury apparently believed that the fireman told the truth and that the station agent did not. The use of the plural "operators" in the verdict suggests that possibly the jurors deemed it their chief duty to punish the "system." This may possibly be justified by the facts, but the language does not sound very business-like from a legal point of view. So much for a coroner's jury. The State Railroad Commissioner, who ought to be able to make a more intelligent investigation than is indicated by this verdict, does not appear to be invested with authority to make a thorough inquiry in cases like this. According to the testimony of a despatcher at the inquest, the road has now issued an order requiring that when a meeting point has been changed, neither train shall pass the point first fixed until the order making the change has been received by both.

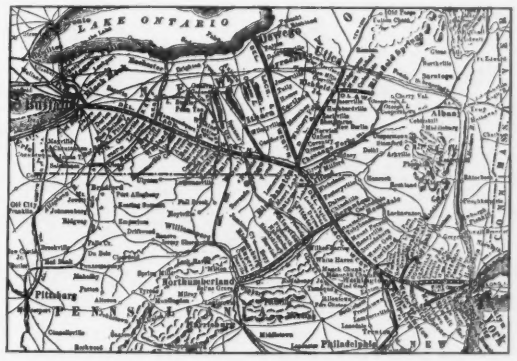
The newspapers have much to say as to the capacity of the Siberian Railroad, and the faults in its construction. The western part, as far as Lake Baikal, had 51-lb. rails; the rest of it 65-lb. The worst of it was probably originally much better than the Union Pacific when first opened, which is not saying much. Its capacity was limited by the small number of stations and passing tracks, as well as by the lightness of the superstructure, which would not admit of the more modern locomotives used in European Russia. But it is now something like two years since it was decided to strengthen the road, and much may have been done since then; for the Russians have performed some of the greatest feats in rapid railroad building in the world's history. In the time since war was threatened it would have been possible to put in passing tracks enough to greatly increase the capacity of the road. The Chinese Eastern, however, has never been reported as completed, and was only provisionally opened for traffic.

### Delaware, Lackawanna & Western.

The fiscal year of the Lackawanna ends December 31, so that the present report compares the business of almost the entire coal strike period with that of the year of recovery, when the mines and the carrier alike were worked to their utmost capacity to fill the general shortage, and this is the chief contributing cause for the remarkable showing made by the company this year, the total income, $16,638,496, being more than twice as great as the total income last year. The period of good times was not confined to any one commodity, however. The total earnings from operation, $29,180,964, comparing with $21,398,764, last year, are classified under seven heads: earnings from transportation of coal, miscellaneous freight, passengers, mail, express, milk and earnings from miscellaneous sources. Each of these items, except the mail contract, shows a gain and in each the gain was noteworthy, earnings from coal transportation heading the list with an increase of $5,680,923, or 69.74 per cent. Earnings from the transportation of miscellaneous freight increased $1,341,484, or over 19 per cent., and earnings from transportation of passengers increased $491,105, or nearly 11 per cent. The gains in recent years in earnings from miscellaneous freight and from passengers constitute an interesting part of the recent development of the system. The following table compares these earnings since and including 1899:

| Year. | Miscel. freight. | Passengers. |
|---|---|---|
| 1899 | $6,300,149 | $3,951,051 |
| 1900 | 6,660,186 | 4,186,232 |
| 1901 | 6,668,688 | 4,522,383 |
| 1902 | 7,013,424 | 4,592,036 |
| 1903 | 8,354,908 | 5,083,142 |

It will be seen that with length of road practically unchanged earnings from transportation of miscellaneous freight have increased from $6,300,149, or approximately $6,652 per mile in 1899, to $8,354,908, or approximately $8,658 per mile in 1903, an increase of 32 per cent., and that earnings from passenger traffic, exclusive of mail and express, which were $3,951,051 in 1899, increased 29




Delaware, Lackawanna & Western.

per cent. to $5,083,142 in 1903, amounting in the latter year to $5,267 per mile, as against $4,172 per mile in the former.

A feature of the current report which is especially gratifying is that the important increases in earnings were attended by very moderate enlargements of the operating expense account. Each of the four general items going to make up the expense account showed an increase, but total expenses, amounting to $15,170,542, were only $1,529,490 greater than in 1902, although earnings increased well over 7¾ millions during the year. In the face of prevailing high wages, increased cost of supplies and the quite universal increases in operating ratio, the showing made by the Lackawanna in this respect is of great interest. The large expenditures which the management has made during the last few years in perfecting its right of way and increasing the capacity of the rolling stock, would seem to be bearing fruit in enabling a greatly increased business to be done on the line at a comparatively slight increase in expense. Having a small system, good credit and no abnormally great engineering problems, the Lackawanna has rounded up in a comparatively short space of time a general scheme of improvement work quite similar to that now being done on a number of the leading railroads, and the current figures illustrate the hopeful side of the heavy betterment expenses which have been prevalent throughout the country during the last few years of prosperity. The report does not give the percentage figure of operating ratio, but for those who like to see earnings and expenses compared in this manner it may be noted that in 1902 the total operating expenses were 63 per cent. of the gross earnings from operation, while in 1903 the ratio fell to 52 per cent. The present ratio, owing to the abnormal coal traffic, which is expected to remain a record for some time, has, of course, no special significance except as showing the flexibility of the lines.

After adding to net earnings from operation $3,500,936, as against $1,193,996 last year, an increase largely due directly to the earnings of the coal department, the total income of $16,638,496 was reached, as against $8,115,337 in 1902. From this $10,553,258 was charged off for interest, rentals, sundry accounts and for renewals and betterments, the last-named appropriation amounting to $4,319,166. The total surplus remaining amounted to $6,085,238, compared with a deficit of $346,652 last year. As previously, 7 per cent. dividends were declared, aggre-

gating $1,834,000, the same as last year. The resultant surplus balance amounted to $4,251,239, as against a deficit of $2,180,652 carried to profit and loss account last year. The detailed statistics of traffic show a striking increase in the average revenue train load, the load averaging 443 tons this year, as against 361 tons in 1902, an increase of nearly 23 per cent.

There were no changes during the year in the outstanding bonds of any of the lines leased by the company, except that the Morris & Essex issued $1,000,000 of its 3½ per cent. refunding mortgage bonds for the purpose of reimbursing the Lackawanna in part for advances made for track elevation and other betterments on the Morris & Essex. The company also acquired during the year a one quarter interest in the Mutual Transit and the Mutual Elevator companies, owning a line of steamers between Buffalo and Lake Superior points and valuable elevator and terminal property at Buffalo. Last May the entire capital stock of the New York & Hoboken Ferry Company, amounting to $3,300,000, was purchased, and it is proposed to extend the New York ferry service during the coming year, making a new terminal at the foot of West Twenty-third street, New York, as described in the *Railroad Gazette*. The entire capital stock and outstanding bonds of the Erie & Central New York Railroad, running from Cortland to Cincinnatus, N. Y., 18 miles, were also purchased.

The following table compares the chief statistics of operation in 1903 and 1902:

| | 1903. | 1902. |
|---|---|---|
| Earnings from trans. of coal | $13,826,844 | $8,145,920 |
| From miscellaneous freight | 8,354,908 | 7,013,424 |
| From passengers | 5,083,142 | 4,592,036 |
| Express | 516,600 | 464,267 |
| Milk | 567,520 | 514,356 |
| Mail | 181,005 | 180,302 |
| Miscellaneous sources | 650,944 | 488,457 |
| Total earnings from operation | 29,180,964 | 21,398,764 |
| Main. of way and structures | 3,647,959 | 3,383,504 |
| Maintenance of equipment | 2,793,086 | 2,712,595 |
| Conducting transportation | 8,264,894 | 7,152,204 |
| General expenses | 464,602 | 392,749 |
| Net earnings | 14,010,422 | 7,757,712 |
| Less taxes | 872,862 | 836,371 |
| Coal department earnings | 3,036,194 | 792,477 |
| Other miscellaneous earnings | 464,742 | 401,519 |
| Total income | 16,638,496 | 8,115,337 |
| Total charges | 10,553,258 | 8,461,990 |
| Net income | 6,085,239 | *346,652 |
| Surplus, after dividends | 4,251,239 | *2,180,652 |

*Deficit.

### Northern Central.

The report for the year ending December 31 shows important gains in freight earnings, due mainly to the anthracite coal traffic, which was, of course, very active after the strike in 1902. Passenger and express earnings also increased considerably, and total gross earnings amounted to $10,310,086, as against $8,456,685 last year. Freight earnings contributed $7,977,121 to the total, as against $6,247,715 last year, and the chief commodity gains, apart from anthracite coal, which increased nearly 2,000,000 tons, were grain, with an increase of 447,310 tons; flour and other mill product, slightly over 200,000 tons; fruits and vegetables, 143,506 tons; bituminous coal, and lumber. Only five specific commodities out of a total of about 35 enumerated showed decreases, the chief of these being in ores and coke hauled. The average train load increased nearly 17 tons, to 406 tons. Passenger earnings increased from $1,726,143 to $1,817,418. But operating expenses increased faster than earnings, chiefly as a result of increases in wages and cost of materials, so that the entire gain in earnings was absorbed by the increased expenses, and net earnings of $2,336,209, prior to rentals, were $15,382 less than last year. Owing to the smaller rentals, however, on a net earning basis, the net operating earnings of the Northern Central amounted to $2,267,045, $76,692 more than last year. Interest on investments also brought in an increase, so that total gross income was over $300,000 greater than in 1902. From the net income, after payment of $10,226 on account of principal of car trusts, and 8 per cent. dividends on the capital stock, there remained a balance of $919,888. From this $908,484 was appropriated as an extraordinary expenditure on track, yards and equipment, and $11,404 was carried forward to credit of the profit and loss account. The profit and loss balance now stands at $3,348,477. The extraordinary expenditure fund had previously to its credit over $1,000,000, and, together with the appropriation referred to, it was able to take care of all extraordinary expenditure during the year without an increase in the capital account. These expenditures aggregated $1,968,123, of which $747,600 was paid for four-tracking from York Haven to Bridgeport, including right of way, and $629,424 was paid for equipment and tools and machinery. The four-tracking and other betterment work between Fairview and York Haven, Pa., as referred to in the annual report for 1902, was necessary in order to provide for the heavy tide-water coal traffic to be thrown upon the line. The work includes a large terminal yard built jointly with the Pennsylvania Railroad at Fairview, on the west side of the Susquehanna River. As to capital changes in the coming year, it is mentioned that $2,000,000 of series C and D consolidated general mortgage bonds will mature July 1, 1904. It is suggested by the management that these loans and also the construction and expenditures necessary during the coming year in excess of the surplus income, be provided for through an allotment of stock to the shareholders. The action required by the laws of the states of Pennsylvania and Maryland previous to such an increase of capital stock was taken last November. Statistics of operation follow:

| | 1903. | 1902. |
|---|---|---|
| Mileage worked | 450 | 450 |
| Gross earnings | $10,310,086 | $8,456,685 |
| Freight earnings | 7,977,120 | 6,247,715 |
| Passenger earnings | 1,817,418 | 1,773,230 |
| Operating expenses | 7,973,878 | 6,105,095 |
| Net earnings, prior to rentals | 2,336,209 | 2,351,590 |
| Gross income | 3,066,550 | 2,765,962 |

## NEW PUBLICATIONS.

*Lectures on Commerce.* Delivered before the College of Commerce and Administration of the University of Chicago. Edited by Henry Rand Hatfield. Chicago: The University of Chicago Press, 1904. Cloth, 8vo., net $1.50; postpaid, $1.62.

This is Volume I. of the publications of the College of Commerce and Administration of the University of Chicago. The lectures contained are under three separate heads, viz.: Railroads, Trade and Industry, Banking and Insurance. There is also an introductory lecture on "Higher Commercial Education," by Prof. J. Lawrence Laughlin. In securing lecturers the endeavor has been to get men who have won eminence in their special line. This plan is also followed by the Wharton School of Finance of the University of Pennsylvania and the Departments of Finance at Dartmouth College and the universities of Michigan and Wisconsin. The subjects in the railroad division and their contributors are: Railway Management and Operation, by A. W. Sullivan, Assistant Second Vice-President, Illinois Central Railroad; Railway Mail Service, by George Gerard Tunell, Secretary to the President, Chicago & North Western Railway; Railways as Factors in Industrial Development, by Luis Jackson, Industrial Commissioner, Chicago, Milwaukee & St. Paul Railway; Some Railway Problems, by Paul Morton, Second Vice-President, Atchison, Topeka & Santa Fe Railway; Railway Consolidation, by E. D. Kenna, First Vice-President, Atchison, Topeka & Santa Fe Railway System. The Trade and Industry division contains, among others, papers by A. C. Bartlett, of Hibbard, Spencer, Bartlett & Co., on At Wholesale; and by Dorr A. Kimball, Credit Man of Marshall Field & Co., on The Credit Department of Modern Business. Banking and Insurance includes among its contributors James H. Eckels, President of the Commercial National Bank of Chicago, and D. R. Forgan, President of the First National Bank of Chicago. Special value to the University from the actual contact between the college men and the man of large affairs, which cannot but be advantageous to the students. The contributors are all men of authority in their respective fields, and the book contains some valuable special knowledge, presented in interesting form. There are sixteen lectures in all. The volume contains 388 pages and an index.

*The New Technical Dictionary (English-German-French).*

Dr. Hubert Jansen, Editor-in-Chief of this work, the compilation of which was begun in 1901 under the auspices of the Society of German Engineers, and the last notice of which was published in the *Railroad Gazette*, May 29, 1903, sends a report of the work done up to February, 1904. The dictionary has received help up to the present time from 363 technical societies at home and abroad, 51 of these being English, American, South African, etc.; 274 German, Austrian and German-Swiss, and 38 French, Belgian and French-Swiss societies. Of firms and individual collaborators, 2,573 have promised contributions.

The study of texts in one, two or three languages (handbooks, pamphlets, business letters, catalogues, price lists, etc.), and of the existing dictionaries has yielded 1,920,000 word-cards so far. To these will be added within the next two years (by the middle of 1906) the hundred thousands of word-cards that will form the result of the original contributions—those already sent in and those still expected—of the 2,573 collaborators at home and abroad, when the editors in Berlin have finished them for the press. Specially-made handy note-books had been placed at the disposal of the collaborators to write their collections in, of which 317 have come in filled so far.

All the outstanding contributions will be called in by Easter of this year, 1904. The collaborators are therefore requested to close their note-books or other contributions—unless a later term has been especially arranged with the Editor-in-Chief—by the end of March, and to forward them to the address given below. As the printing of the Technolexicon is to begin in the middle of 1906, delayed contributions can be used in exceptional cases only up to that time. The Editor-in-Chief will be pleased to give any further information wanted. Address: Technolexicon, Dr. Hubert Jansen, Berlin (NW. 7) Dorotheenstrasse 49.

*Proceedings of the 11th Annual Convention of the Travelling Engineers' Association.* Edited by the Secretary, W. O. Thompson, Oswego, N. Y., 1903. Flexible leather, 290 pages.

This is one of the younger railroad mechanical associations, but the scope and quality of its discussions and investigations are an indication of its usefulness and progressive attitude. The papers and discussions presented at the 11th annual convention, held in Chicago, Sept. 8 to 11, 1903, cover a wide range of subjects pertaining to the design and operation of locomotives. The travelling engineer is best qualified to judge from actual road trials of the value of improvements and changes in locomotive designs and the opinions expressed in the discussions of the Association, while often at variance with accepted ideas or the opinions of other members, are always worthy of consideration. This volume of the Proceedings contains all the papers and discussions, lists of members, constitution, committees, officers and a brief index. Copies may be had from the Secretary.

*Proceedings of the Society for the Promotion of Engineering Education.* Vol. XI. New York: Engineering News Publishing Co., 1903. Cloth, 380 pages. Price $2.50.

The papers and discussions contained in this volume are virile and on timely topics. Teachers of engineering are conservative but free from the influence and control of tradition and the trend of their ideas is not in one narrow channel. The influence which such an organization as this has upon educational thought along engineering lines cannot be overestimated and any reader will be well repaid for a careful reading and study of the ideas and opinions expressed before the Society and contained in the volumes of the Proceedings. One of the most valuable features of Vol. XI. is a list of engineering reference works compiled as a basis for a library and covering nearly every field of scientific and engineering research. The list is representative and well selected.

*Proceedings of the 34th Annual Convention of the Master Car and Locomotive Painters' Association.* Chicago: The Railway Master Mechanic, 1903. Cloth, 150 pages.

This volume of the Proceedings contains besides the lists of officers, committees and members of the Association for the year 1903-04, the full text of the papers and discussions presented at the 34th convention, held in Chicago, Sept. 8 to 11, 1903. Among the topics considered the following were perhaps of the most general interest: Heating and ventilating car and locomotive paint shops; painting and maintaining locomotives; painting and maintaining steel cars, and copper-sheathed lumber for cars.

## TRADE CATALOGUES.

*The Laidlaw-Dunn-Gordon Co.*, New York, in Bulletin L-508, describes the improved Cincinnati air compressor. The distinguishing feature of this machine is the manner in which the opening and closing of the exhaust ports are controlled. The exhaust opens through poppet valves, a desirable feature especially where the pressure pumped against is variable. The closing of the exhaust is determined by Corliss valves located in the passages between the cylinder and the poppet valves. These prevent all leakage of air back through the poppet valves while they are closing and also, by providing a cushion of air under full pressure, allow them to seat easily and without noise. The opening and closing of the admission are determined by the Corliss valves entirely.

The March number of *Graphite*, issued by the Joseph Dixon Crucible Co., Jersey City, N. J., contains articles on Dixon's paints at the navy yard; on paint specifications for steel and iron; on the new Hotel Astor, Long Acre square, New York; on Keith's new theater in Philadelphia; the H. R. Worthington Hydraulic Works of the International Steam Pump Company; the new Seventy-first Regiment Armory; the Hotel Belvedere, at Baltimore, etc. All of the structures named have made use of Dixon's graphite productions. The paper is illustrated with 13 photogravures and two line drawings.

*American Blower Company*, Detroit, Mich., Catalogue 159, brick-drying machinery. The "A B C" waste-heat drying system is explained, and particularly its application to, and advantages in, brick drying. All of the apparatus needed, including blowers, engines, dryer cars, etc., are described and illustrated in detail. A part of the book gives the experience of users, showing half-tone views of the plants, with testimonials from the owners. The pamphlet is attractively designed and is printed on enamel paper; it contains 78 pages. It will be sent to persons interested upon application.

*Dallet Pneumatic Tools* are described in a catalogue recently issued by Thos. H. Dallet Company, Philadelphia. Pneumatic hammers, chisels and rivet set shanks, and pneumatic hose couplings made by this company are finely illustrated. Several paragraphs giving useful directions for the care of hammers are included. The riveting and chipping hammers are shown in detail, with each part numbered and named to assist in ordering duplicate parts.

*The Republic Railway Appliance Company*, St. Louis, Mo., has sent out a little folder with the title, "A Reminder," which calls attention to the good qualities of Flatau's front-end and stack paint. This paint is now being used by 72 roads. The cover design of the folder is original and in keeping with the title. It represents a hand, life size, around the middle finger of which is tied a piece of string (not a picture of a string).

*The Chicago & North Western* has arranged six tours to Alaska during the summer of 1904, leaving Seattle, Tacoma and Victoria, June 7 and 21, July 5 and 19, and August 2 and 16, and has issued a special folder giving full particulars, with Alaskan views and excellent maps. The rate for the round trip from Puget Sound ports, including berth and meals on steamer, is $100, the cruise lasting 11 days.

*Buffalo Forge Co.*, Buffalo, N. Y., has published two

handsomely illustrated pamphlets, one describing its line of centrifugal pumps and the other showing a number of types of steel-plate planing mill exhausters. Tables of sizes, capacities and other useful information are included in each.

### Capitaine's Crank-Pin Turning Machine.

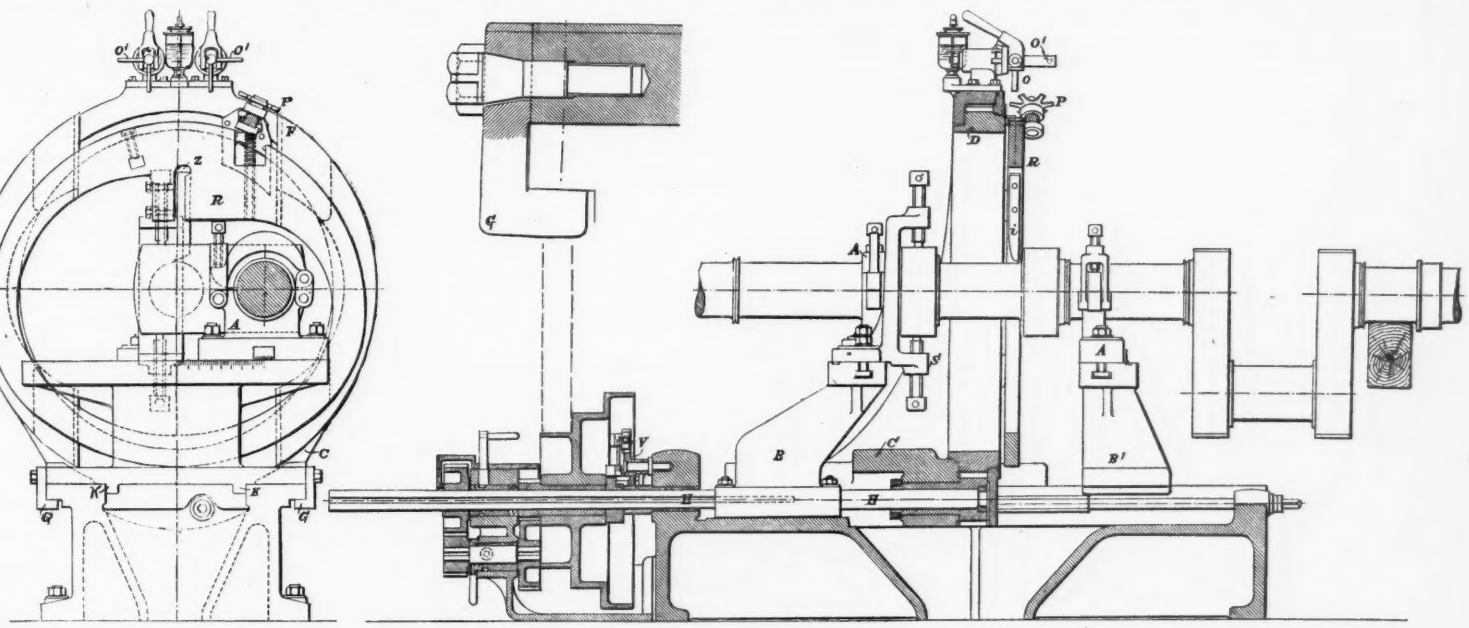
The idea of tooling the pins and webs of crankshafts in a machine in which the crankshaft is stationary and the tool rotating is far from being new, the first machine of this design having been built at Havre about 50 years ago. Though the advantages of this manner of working are obvious, the machine has not found an extensive application, owing in certain cases to imperfections in the design of the mechanical parts, which did not allow of turning out the work dead true or of taking heavy cuts.

Some time ago Messrs. E. Capitaine and Company, of Frankfort-on-Main, put on the market a new machine on this principle, the design embodying high accuracy and great stability. The machine in actual work on a crankshaft is shown by the accompanying illustration. Referring to the figures, it will be seen that the bearings A with hinged caps for taking the crankshaft, are supported, one by the casting B, fixed to the bed of the machine, and the other by the casting B′, capable of sliding on the bed. The bearings A are adjustable at right angles to the center line of the crankshaft; fine adjustment, up to $^1/_{20}$ millimeter (0.0127 in.), being carried out by means of a vernier and scales on B and B′. This allows the center of the pins to be placed coincident with the center line of the machine in the shortest possible time. In order to avoid bending of the heavy overhanging portion of the crankshaft, it is desirable, especially with long but not very heavy shafts, to counterbalance the overhanging part, instead of supporting it in the usual manner. The shaft is prevented from turning by the holder S. The tool is held in a recess Z in the disc R, the latter being made of cast steel. This disc is guided by projections F, which are attached to the rotating ring D. The feed of the tool-holder R, with its tool, is accomplished by means of the star-wheel P and the pins OO. The latter are adjustable by means of a lever-handle, according to the feed required; and by the engagement of another pin the movement of the star-wheel may be reversed.

The main features of this machine are its rigidity and the care taken to accurately guide the slide R, in which the tool is held. This enables heavy cuts to be taken without setting up vibrations. Larger sizes of the machine, those for tooling crankshafts of 12-in. throw and over, are fitted with two tool-slides, and therefore work with two tools at the same time. With the machine for crankshafts of 24-in. throw it is possible to take cuts corresponding to an output of 0.3 tons of shavings per hour. A special feature of the machine consists in the guide for the slide C. This slide rests on the wide surface of the bed, and is guided on one side by the slide-guides G and on the other side by the projections K. The slide-guides G serve merely to hold down the saddle, and are attached by tapered bolts, as shown. The heads of these bolts are smaller than the holes into which they fit, and a certain amount of "draft" is therefore available for tightening up the guide-piece when necessary. The feed arrangement V consists of an eccentric, a double lever, a movable pin, and a double pawl and ratchet wheel. Five different speeds of feed can be obtained. The feed device can produce a movement in either direction, and acts nearly continuously.

The machine is driven by a belt from countershafting with a three-step pulley, and a gear capable of being disengaged. By means of the latter, six different speeds may be obtained from the tool $c$. The movement is transmitted from the gear V by the shaft H with keyway, the spur gear J, and the toothed rim of the part D. The illustration shows a machine with two tools.

We are indebted to *Engineering* for the details and description of this machine.



Capitaine's Crank-Pin Turning Machine.

### The Railroad Telegraph Department.*

The frequent merging of small railroads into large railroad systems during the past ten years has increased the demand for improvement in the railroad telegraph department. The immense territories now covered by the various large systems demand the utmost energy of every official, and without a perfect knowledge at all times of the doings of his department, his energy and ability are impotent. Distances are too great, competition too prevalent, mail service is too slow. But improvements in this department have not advanced with the requirements. Abuse of the service with unnecessary messages is endless.

As a rule, in the railway telegraph department, too much attention is given to discussing opinions as to how telegraph lines should be constructed, leaving the most important features, those of operation and maintenance, for self-development. The usual contract which exists between the railroad companies and the Western Union Telegraph Company provides that the railroad companies will furnish the labor, remove interruptions and maintain the lines, and that all construction and reconstruction will be under the direct supervision of the Western Union, which furnishes a foreman and all the material. Operating under this contract, the energy of the railroad telegraph department should be confined to securing the best facilities for removing and preventing interruptions, the arrangement of the best circuits and the careful selection of the most competent class of operators, messengers and linemen.

The proper selection of operators is a panacea difficult to prescribe. The telegraph is the only department connected with the operation of a railroad that is not constantly educating new employees for its service. With the constant increase in the number of offices to be maintained, the general qualification of railroad operators is far below what it was ten years ago. Ask any high official to show you copies of messages he receives from station to station as he passes over the line, and you will find more than 50 per cent. of them incomprehensible, and except for the official's familiarity with his business and power of mind reading, they would be utterly useless.

While the railroads are spending millions for various equipment to reduce expenses and improve operation, not one cent nor one moment's time is devoted to procuring and carefully training operators. When an operator is to be employed it is a fish-net proposition, and whatever is caught is pressed into service; habits and qualifications are not fully known for some time afterwards. One appropriate remedy for this condition would be the formation of a telegraph school by as many as five or six large railroads. Recruiting employees from among the people living along the lines of the railroads interested would help to identify the interests of the communities with the interests of the railroad company. Such an arrangement could not fail to have good results, and there is no apparent reason why an important percentage of the operators of a railroad company should not gradually be drawn from among the citizens living along its lines.

*From a paper by J. C. Browne, General Foreman of the Telegraph Department of the St. Louis, Iron Mountain & Southern, before the St. Louis Railway Club.

## TECHNICAL.

### Manufacturing and Business.

The American Water Softener Company, of Philadelphia, will open a branch office at Columbus, Ohio.

The American Castings Co., of Birmingham, Ala., will increase its capital from $20,000 to $50,000, and will build a new foundry.

The Independent Railroad Supply Company, Chicago, has received an order for 10 miles of Wolhaupter rail joints for 100-lb. rail from the Chicago, Milwaukee & St. Paul.

The Coughlin-Sanford Switch Co., 25 Broad street, New York City, has received an order from the Pittsburg, Shawmut & Northern for a lot of Coughlin swing-rail frogs.

The annual meeting of the stockholders of the Compressed Air Co., of New York, is to be held March 7. It is announced that a plan of reorganization is being prepared.

The Ajax Manufacturing Co., of Cleveland, has sold to the Canadian Pacific six of its heading, forging and upsetting machines for the new shops at Montreal and Winnipeg.

Messrs. Adreon & Co., Security building, St. Louis, have, since January 1, been agents for the sale of the Symington journal box and dust guard in the St. Louis and Southwestern territory.

Hale & Kilburn, Philadelphia, expect to have their new factory at Eighteenth street and Lehigh avenue, ready for occupancy by June 1. The company makes special furniture and railroad car seats.

The Reynolds Steel & Iron Co., of Albany, has been incorporated in New York to make iron and steel. The incorporators are Dexter Reynolds, Marcus T. Reynolds, and Cuyler Reynolds, all of Albany.

The G. Drouvé Company, of Bridgeport, Conn., maker of the well-known Lovell window and shutter operating device, also of cornices, skylights and ventilators, has opened a branch office in New York City at 22 East 21st street.

The Georgia Car & Mfg. Company has just completed 25 flat cars for the Georgia & Alabama railroad. The company has also received an order to repair and remodel the entire tank car equipment of the Producers' Tank Lines.

John B. Watson, Drexel Building, Philadelphia, Pa., engineer and broker in rails, railroad equipment and light and power machinery, has recently added an electrical department to his business, with A. B. Sanders in charge.

The Marion Manufacturing Co., of Marion, Ohio, has been incorporated in that state with a capital stock of $400,000 to make machinery. The incorporators are Fred Haberman, C. C. Fisher, H. Tisholm and others, of Marion, Ohio.

The Jordan Automatic Signal Co., of New York City, has been incorporated, with a capital of $100,000, to make electrical signals. The incorporators and directors are Wm. H. Jordan, C. C. Jordan and J. F. Jordan, all of New York City.

The American Ultimator Co., of Buffalo, has been incorporated in New York with a capital of $50,000, to make lifting machines. The directors are William Middleton and Mark Packard, of Buffalo, and J. N. Henchen, of Welch, W. Va.

The District of Columbia appropriation bill, as reported in Congress last week, for the fiscal year ending June 30, 1905, provides for $968,155 for the new filtration plant now under construction, and $300,000 for the change of street grades and construction of a plaza in front of the new Union railroad station.

In the description of the system of rail chairs and fastenings used in city streets by the New York Central, which was published in the *Railroad Gazette*, February 26, p. 146, no mention was made of the makers of the tram-bar attachment. This is made by the Continuous Rail Joint Company of America, Newark, N. J.

The "Solid" draft gear, made by the Solid Draft Rigging & Equipment Company, Terre Haute, Ind., is being put on ten 60,000-lb. coal cars being built by the Southern Indiana at its shops at Bedford, Ind.; also on 20 60,000-lb. dump cars for the same road, being built by the Barney & Smith Company, and on 12 60,000-lb. cars for the Lorain & Southern, also building by the Barney & Smith Company.

The Martin Car Heating Company, with general offices

at 1611 Fisher Building, Chicago, has been formed to handle Martin and other patents on car-heating apparatus. These include direct steam, hot-water and locomotive equipments, large size interchangeable steam couplers, improved steam traps, hot-water heaters for steam and electric cars, and all styles of car-heating valves. C. W. Martin, General Manager, was formerly General Agent at Chicago for the Consolidated Car Heating Company.

Roberts, Schaefer & Co., Consulting and Contracting Engineers, 1275 Old Colony Building, Chicago, have succeeded to the business heretofore conducted by Warren R. Roberts, and have enlarged its scope to include the designing and installing of complete coal mining equipments and coal washeries. The members of the firm are Warren R. Roberts, John V. Schaefer, formerly with the Link-Belt Machinery Company; John J. Roberts, formerly with George A. Fuller Company, and Frank E. Mueller, formerly with the Link-Belt Machinery Company.

Will H. Bloss, heretofore Chief Engineer and Roadmaster of the Indiana Union Traction Company, has resigned to accept a position with the Paige Iron Works, Chicago, which is the switch and crossing department of the Buda Foundry & Manufacturing Co. He will travel from the Chicago office, giving especial attention to increasing the urban and inter-urban work of this company. Mr. Bloss was with the Indiana Union Traction Company for five years, and had a large part in bringing the system up to its present magnitude and efficiency. He relieves E. S. Nethercut, Chief Engineer of the Paige Iron Works, of the care of outside matters, and the latter, who has been with the company for over 12 years, will direct the sales from the Chicago office and look after the engineering of the company.

Colonel John T. Dickinson, Vice-President of the Consolidated Railway Electric Lighting & Equipment Co., New York, is authority for the statement that the Consolidated Company has more of its "Axle Light" equipments of electric car lighting in use on the finest trains of the leading railroad lines than all other systems of electric car lighting combined, and also that the officers of several of the great railroad systems in the country, where a large number of "Axle Light" equipments have been in service for the past few years, have concluded that Consolidated "Axle Light" is the cheapest to install and maintain and the most efficient system of electric car lighting yet devised. Each car carries its own independent electric car lighting apparatus, ready for immediate and constant use, no matter in what service the car may be placed.

The receivers of the Southern Car & Foundry Co. are finishing the contracts that have been begun to use up the material on hand, and they are now desirous of disposing of the plants. Interested parties are requested to communicate with the receivers at their office at Birmingham, Ala. The plants are located at Memphis, Tenn.; Lenoir City, Tenn., and Gadsden, Ala. All of them are adapted for the advantageous manufacture of articles in wood and iron that can be produced with the facilities requisite for the construction of freight cars. All three of the plants have woodworking and ironworking equipment, and both Gadsden and Memphis have foundries, the latter having a wheel foundry as well as a grey-iron foundry. All the plants have sufficient area to permit of whatever additional buildings or machinery which may be needed for special products other than cars. Cash offers are preferred, but consideration will be given to any alternative proposition.

### Iron and Steel.

The Tennessee Coal, Iron & Railroad Co. will make extensive improvements at Ensley, to include a new tipple to cost about $20,000.

The Republic Iron & Steel Co., at its Thomas furnace, has started the No. 3 stack, which is the largest in the South, with a capacity of 300 tons a day.

The Passaic Steel Company, of Paterson, N. J., has finished its open-hearth steel plant, and will shortly begin making steel in the new furnaces, which will about double the company's output.

The report comes from Cleveland that the United States Steel Corporation has given a contract to the furnaces of the Bessemer Pig Iron Association for 130,000 tons of Bessemer iron at $13 a ton at the Valley furnaces. This will require the combined output of all the furnaces in the Mahoning and Shenango valleys, some of which had been idle for six months.

The rail mills have orders booked for steel rails, this year's delivery, amounting to 1,400,000 tons, which, with the orders likely soon to be received, will take up over one-half the total annual capacity of all the mills. For the last five years the production and prices have been:

| | Tons. | Price. |
|---|---|---|
| 1903 (estimated) | 2,500,000 | $28.00 |
| 1902 | 2,941,421 | 28.00 |
| 1901 | 2,870,816 | 27.33 |
| 1900 | 2,383,654 | 32.29 |
| 1899 | 2,270,565 | 28.12 |

### Changes in Management of Mercantile Marine.

Following the election of Bruce Ismay as President of the International Mercantile Marine Company, announcement is made that the practical work on this side of the ocean will be conducted by Mr. John Lee, for years Manager, in this country, of the White Star Line, and by Mr. P. A. Franklin, of the Atlantic Transport Line. Mr. Franklin was already a vice-president of the International Mercantile Marine, and Mr. Lee has been elected also to that position. Mr. James A. Wright, Jr., is to have charge of the American passenger business of all the lines.

### Hollow Staybolts.

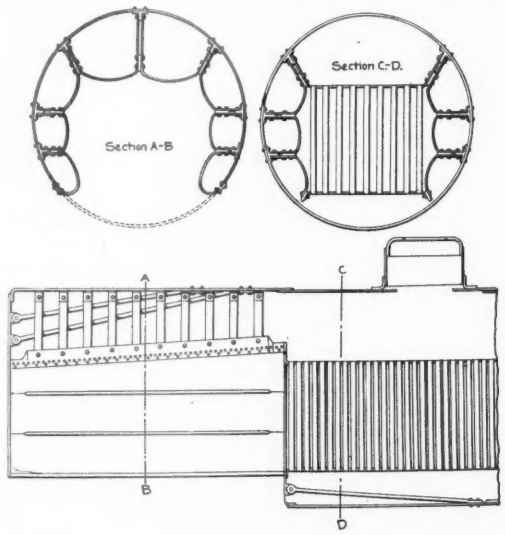
General Uhler, supervising inspector-general of the steamboat inspection service, U. S. Department of Commerce and Labor, appointed a special committee to investigate and report on staybolts. Their report, approved by General Uhler, concludes as follows: "We are of the opinion that the Falls hollow staybolt is safe and efficient for use in the construction of locomotive and marine boilers."

### Electric Lighted Cars on the Alton.

The Chicago & Alton announces that all of the cars in all of its trains are to be equipped with electric lights. This is an exuberant statement of the passenger department, meaning all of the cars in the passenger trains of the company. The light is to be produced by dynamos attached to the axles of the cars. The announcement says that the work is to be proceeded with immediately. How fast the cars will be equipped does not appear, but we understand that the Consolidated Railway Electric Lighting & Equipment Company has a contract for some or all of the work required.

### The Hottman Water-Tube Locomotive Boiler.

The accompanying illustration shows a novel design for a water-tube locomotive boiler, patented by J. F. Hottman, Dubuque, Iowa. The sides and crown of the fire-box and the sides of the barrel consist of curved plates with their concave surfaces towards the water side. The barrel has horizontal top and bottom tube sheets. The fire-box has an open bottom, with the lower set of side plates bent to form a butt joint with the outer shell. Between the flanged edges of the fire-box plates are riveted reinforcing bars, which are connected to the shell at intervals by




link stays. It is claimed that the curving of the sheets dispenses with staybolts, as the tensile strength of the sheets will resist the boiler pressure. The water space about the fire-box is also increased. Furthermore, no seams or rivets are exposed to the fire. The tube sheets in the barrel of the boiler are connected by a series of staggered vertical water-tubes. The steam globules formed in the tubes pass freely upward, which it is claimed, gives a quick and free steaming boiler. The tubes are easily inspected and being relatively short are not so apt to leak as the long tubes in the ordinary type of locomotive boiler. The interiors of the tubes can also be cleaned without removing them.

### Underground Telegraph from London to Carlisle.

The British Post-Office Department has nearly completed its underground telegraph line from London northward to Carlisle, about 300 miles. It will be remembered that this underground work was begun about two years ago, chiefly for the purpose of preserving communication in case of the destruction of aerial lines by severe storms. Since the first part of the line was laid (London to Birmingham) some changes have been made in construction and the cost has been reduced. Sections aggregating 120 miles have been laid at a total cost of $675,000. The cables now being laid are made up of 103 wires incased in a lead sheathing, the whole contained in a 3-in. cast-iron pipe. Most of the wires are twisted in pairs, but some of them are single wires separately wrapped with a tape of copper to prevent induction. The wires twisted in pairs are used for metallic-circuit telegraphing; without the return conductor it is found impossible to attain reasonable speed in transmission. These English underground telegraphs were described in the *Railroad Gazette* of Dec. 26, 1902, and Nov. 27, 1903.

### Dinner to Thomas A. Edison.

The annual dinner of the American Institute of Electrical Engineers was held at the Waldorf-Astoria on February 11. Mr. Thomas A. Edison was the guest of honor and the occasion commemorated his fifty-seventh birthday. The year 1904 also marks the twenty-fifth anniversary of the commercial application of the incandescent lamp. Addresses were made by President Bion J. Arnold, introducing the toastmaster, T. C. Martin; by Samuel Insull, Chairman of the Edison Medal Association; by Charles L. Edgar, President of the National Electric Light Association, and others, and messages were read from the governors of Ohio, New Jersey and New York; from President Francis, of the Louisiana Purchase Exposition; from Mr. Carnegie, Lord Alverstone, Lord Kelvin, and from electrical engineering organizations of Germany, England and Italy. After a toast was drunk to Mr. Edison he transmitted his response over a telegraph wire to Mr. Chandler, President of the Postal Telegraph Cable Company, who was also seated at the guest table. Others at the guest table with Mr. Arnold and Mr. Edison were Professor C. F. Brackett, Mr. John Fritz, Mr. Samuel Insull, Mr. C. L. Edgar, Dr. A. E. Kennelly, Mr. Joseph B. McCall, Colonel R. C. Clowry, Professor Elihu Thompson, Mr. W. J. Wilgus and Mr. T. C. Martin. On behalf of the Institute, Professor A. E. Kennelly announced the completion of the arrangements for the establishment of an Edison medal, to be annually awarded for notable work in electrical engineering.

### The Traveling Engineers' Questions on Examinations.

The Committee of the Traveling Engineers' Association on Standard Form of Examination sends out the questions given below. If no printed list of questions is used in the examinations the committee wants copies of questions used in oral examinations; also lists of questions on machinery not in general service on all roads, such as compound engines, electric headlights and oil burners. Also questions on the air-brakes, dealing with the high-speed brake and the operation and care of the New York duplex pump and 1902 model New York brake valve.

*Questions.*—(1) Do you examine new men when employed as firemen? If so, of what does the examination consist? (2) Is any other examination required before the time for promotion to engineer? If so, after how long a service as fireman are they examined again? (3) Do you believe in progressive examination? (4) After how long a service as fireman are they examined for promotion to engineer? (5) Are firemen who have had previous service on other roads examined the same as new men? (6) When employing engineers what examinations are they required to pass? (7) Does each candidate for examination have the same list of questions? (8) Have you a printed list of questions? If so, please send us a copy? (9) If not, please tell in detail on what subjects you would examine a new man hired as fireman. (10) A fireman about to be promoted? (11) An engineer about to be employed? (12) What percentage is necessary to pass a candidate? Replies are to be sent to Charles Haukole, Chairman, Eagle Grove, Ia.

### The American Society of Civil Engineers and the Union Engineering Building.

On February 14, 1903, Andrew Carnegie made a formal announcement of his willingness to give $1,000,000 for the erection of a Union Engineering Building in New York City, to be occupied as the permanent home of the four great national engineering societies. Shortly afterward, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers took final action, and on their behalf accepted the gift. The American Institute of Mining Engineers also took initial steps toward making changes in its constitution and rules in order that it, too, might accept, after the sentiment of its members was shown to be overwhelmingly in favor of the plan as a result of a letter ballot. The Engineers' Club of New York was also included in the plan of the bequest, and it having already secured an option on property on 39th street, between Fifth and Sixth avenues, the idea was proposed and accepted that the ground through to 40th street be secured and the Engineering Building be built on that side and join on to the new home of the Engineers' Club on 39th street, thus putting the Societies and the Club under one roof. All the details of the scheme are now in the hands of a committee composed of representatives of the three societies mentioned and the Engineers' Club. When the gift was first proposed the American Society of Civil Engineers took no definite action, but deferred its consideration until the annual meeting held at Asheville, N. C., last June. The proposition was then thoroughly discussed and a strong opposition developed, with the result that the whole matter was referred to the Board of Directors with instructions to canvass the vote of all the members by letter ballot, on the result of which the action of the Society, as a body, would depend. Two months ago the ballots were sent out and on Wednesday evening, March 2, the votes were counted. The result was 662 votes in favor of accepting the gift, and 1,139 votes against its acceptance. Thus by a decisive expression of opinion the American Society signifies its intention to remain a separate and individual organization in its own home. So far as it is concerned this action is final and the incident is closed.

### Wyckoff Pipe & Creosoting Co.

This company, whose offices are at Stamford, Conn., and works at Portsmouth, Va., has been creosoting timber since 1881 and as many of its installations have been in successful use for 20 years, it has had opportunity to study and apply the methods for each kind of timber used for railroad ties, wharf and bridge timbers, conduits for underground wires and cables, poles, crossarms, piles, paving blocks, fence posts, etc. Among the company's important customers are the Bell Telephone Companies, who purchase millions of feet of conduit every year.

The company's process is to first subject the timber to live steam under pressure, after which creosote oil (dead oil of coal tar) is forced into the wood under high pressure. This method has proved so satisfactory that the company guarantees that its creosoted timber will never rot. Creosoted timber is an excellent insulator and is valuable on third-rail systems and other electrical installations. Only recently several carloads of creosoted lumber were shipped for insulating third rails in mines.

Some time ago the company received a number of pieces

of conduit from the Bell Telephone Company, of Philadelphia, with the statement that it was obliged to take up some of the Wyckoff conduit, laid 15 years ago, on account of the subway now being built by the Philadelphia Rapid Transit Company. The Bell Company wrote that every piece was found to be in a perfect state of preservation, and that even the small tenons were as sound as the day they were laid. The United States Department of Agriculture has asked for a piece of this conduit, to be placed on exhibition in Washington, and also has made a request for two pieces to be sent to St. Louis.

This company also makes wooden water pipe out of white pine. A 6-in. creosoted pipe is used for drainage under railroads. It is far superior to iron as it is much cheaper and will not deteriorate nor does it break in handling, like terra-cotta pipe.

### Imports and Exports of Iron and Steel.

According to the Treasury Bureau of Statistics, the value of iron and steel imports for the year 1903 shows a slight decrease from that of 1902. The figures are: 1902, $41,468,826; 1903, $41,253,333. Although the total production of pig iron in the United States for the whole year was 18,009,252 tons, against 17,821,307 tons in 1902, the value of imports of pig iron for 1903 was $11,173,302, against $10,935,831 in 1902. The value of iron ore imported decreased from $2,583,077 to $2,261,008. Imports of bar iron, however, increased in value from $1,286,238 to $1,904,469, while the value of ingots, blooms, slabs, billets, etc., decreased from $7,943,818 to $7,331,299. The following table shows the changes in imports of the various iron and steel commodities during the last two years:

| | 1902. | 1903. |
|---|---|---|
| | Tons. | |
| Iron ore | 1,165,470 | 980,440 |
| Pig iron | 625,383 | 599,574 |
| *Bar iron | 32,305 | 48,462 |
| *Ingots, blooms, slabs, billets, etc | 324,036 | 292,946 |
| *Sheet, plate and taggers' iron and steel | 8,015 | 13,094 |

* In tons of 2,000 lbs.

The export figures show slight decreases in several commodities, but increase in the general total. The value of cars exported during the year was $2,351,853, against $2,699,185 in 1902, and the value of locomotives decreased from $3,966,007 to $3,097,571. The total value of iron and steel exported, not including ore, for the 12 months ending 1903, however, was $99,036,697, as compared with $97,892,036 during the same period in 1902. The following table gives the figures in tons for 1903 as compared with 1902:

| | 1902. | 1903. |
|---|---|---|
| Iron ore, tons | 88,445 | 80,611 |
| Pig iron, tons | 27,487 | 20,381 |
| *Bar iron, tons | 24,919 | 21,706 |
| *Ingots, blooms, billets, etc., tons | 2,409 | 5,445 |
| *Sheets and plates (iron and steel), tons | 20,496 | 20,187 |
| Rails, tons | 67,455 | 30,656 |
| Locomotives, number | 368 | 287 |
| Car wheels, number | 21,714 | 18,966 |

* In tons of 2,000 lbs.

### One-Man Trolley Cars.

According to the street railway section of the *Commercial & Financial Chronicle*, the Southport Tramway Company, operating 17 miles of track in the town of Southport, a favorite seaside resort in England, sustained a loss last year of $10,000, owing to the fact that the population possessed the English characteristic of preferring to walk when the weather was fine, and also to the uncommon circumstance that the weather was always fine. No doubt this combination of circumstances did wonders for the health of the community, but that did not in the least benefit the financial condition of the company. There was need for immediate action. Cutting down the number of cars run would only have made matters worse, for with a poorer service trolley rides would become even less popular, so that the loss in fares would probably exceed the reduction in operating expenses.

As a solution of the problem one-man cars are used. The services of the conductor are dispensed with, his duties being performed by the motorman. The rear platform is closed by a gate and passengers enter the car by the front platform. The entrance to this is obstructed by a bar which must be lifted to permit passengers to enter or leave the car. When the bar is lifted it operates a switch which cuts off the power from the motors, so that when anyone attempts to enter or leave the car the motorman is immediately made aware of the fact. An equally important purpose of the switch is to provide a ready and simple means for stopping the car in case the motorman should in any way become incapacitated. Furthermore, the danger of injuring a passenger by prematurely starting a car is avoided, because the power cannot be turned on while the bar is up. The motorman collects the fares as the passengers enter the car, a system which is liable to cause delay until the passengers learn to have their fares ready; but it minimizes the chances of defrauding the company.

The one-man car weighs only 4½ tons and has accommodations for 20 persons. The main body of the car has 14 seats, while the smoking compartments, located at the ends, contain three seats each. It is said that an exhaustive series of tests has thoroughly proved the efficiency and economy of the new cars. The saving in power over the old cars used by the Southport Company is not proportionate to the number of passengers carried, but is sufficient to make the new cars a success. The latter consume 0.28 unit per car mile, as compared with 0.55 unit consumed by the old cars, which have accommodations for 56 passengers.

The new cars are to be used only during the slack hours of the day, and the Southport experiment may be of interest in this country for the operation of lines through sparsely settled country, or to enable the operation of a more frequent service on certain lines where traffic is light.

## THE SCRAP HEAP.

### Notes.

The last announcement made in the grain rate war between Buffalo and the Atlantic seaboard is one of 1.8 cents a bushel on wheat to Philadelphia.

Judge Dobler, of Baltimore, has dismissed the suit of the Western Maryland to restrain the Baltimore & Ohio from diverting freight to the Cumberland Valley.

The Chicago Shippers' Association is a new organization just established, and it is to be incorporated under the state law. The president is A. C. Bartlett; secretary, J. T. Berry, Jr.: treasurer, E. A. Turner.

After being out three years, the Chicago, Rock Island & Pacific has decided to again join the Western Passenger Association. Its withdrawal was the result of disputes over the division of the military and immigrant traffic.

The State Railroad Commissioner of Wisconsin has asked of the railroads of the state lists of the free passes which they have given to state officers. The law forbids the use of passes by public officers, but it is alleged that certain assistants in the office of the Attorney-General have violated the law.

The Attorney-General of Texas has begun a suit against the American Express Company to recover $6,000,000 for violating the anti-trust law of that state. The principal offense appears to have been the making of the contract under which the company does business on the lines of the Missouri, Kansas & Texas. Similar suits are to be begun against other express companies.

The Rock Island road now issues a separate mileage book, in addition to the interchangeable mileage of the Western Passenger Association. The new book covers 3,000 miles and is sold for $75, with no refund. It is good on the Rock Island system, and on fourteen other lines west of the Missouri River, including the Denver & Rio Grande and the Colorado Midland and Colorado Southern.

A press despatch from Chicago says that the round-trip rates to the St. Louis Fair this summer from stations in the territory of the Western Passenger Association are to be as follows: Season tickets—From all points, 80 per cent. of double the one way standard fare. Sixty-day tickets—From points from which the one-way standard rate to St. Louis is $3.75 or less, 80 per cent. of double the one-way standard rate; where the one-way rate is more than $3.75, one and one-third fare. Fare and one-fifth excursions—From points from which the standard one-way fare is $8 or more, one and one-fifth fare.

The grain rate war from Omaha to Eastern points, which was started by the Chicago Great Western a month or two since, when it opened its line to Omaha, appears not to afford sufficient scope for the activities of that enterprising road, and Chicago despatches of this week report cutting in the rates on sugar westbound; also, on one or two other commodities. It is said that the Burlington at once met the reduction on sugar and at last accounts the rate from Chicago to the Missouri River was 10 cents per 100 lbs., which is only about one-third the normal rate. A still greater reduction was made to St. Paul.

### Isthmian Canal Commission.

It is announced from Washington that the Secretary of the Commission will be General Edward C. O'Brien, of New York City. Gen. O'Brien was United States Commissioner of Navigation from 1889 to 1893, and was Dock Commissioner of New York City under Mayor Strong.

### Russian Railroad Report of 1901.

The financial report of railroad revenues during 1901, just published, show a loss of $7,210,000. During the period of 1897-1900 the annual profits were between $5,665,000 and $9,785,000. The revenues, which amounted to $307,455,000, exceeded the expenditures by $77,765,000. The deficit must be attributed to bad crops and to the construction of 3,000 miles of new lines. The greatest deficit was that of the Siberian Railroad, which amounted to $11,330,000.—*Consular Report.*

### The London Traffic Commission.

The Royal Commission on London Traffic has appointed a technical sub-committee to report on special subjects. It consists of Gen. William Barclay Parsons, Chief Engineer of the New York Rapid Transit Commission; Sir Benjamin Baker, of London, and Sir J. Wolfe Barry, already a member of the Royal Commission. The appointment of Gen. Parsons as Commissioner of the Isthmian Canal is understood not to interfere with the London appointment, and he expects to sail for England some time in April.

### Isthmian Canal Commission.

President Roosevelt, on Monday last, sent to the Senate the following nominations:

Chairman of the Isthmian Canal Commission, Rear Admiral John G. Walker, U. S. N. (retired), of the District of Columbia.

Members of the Isthmian Canal Commission—Major General George W. Davis, U. S. A. (retired), of the District of Columbia; William Barclay Parsons, of New York; William H. Burr, of New York; Benjamin M. Harrod, of Louisiana; Carl Ewald Grunsky, of California, and Frank J. Hecker, of Michigan.

### Michigan Passenger Fare Law.

The United States Supreme Court has decided the case of the Michigan State Railroad Commissioner against the Grand Rapids & Indiana involving passenger fares on that line. The action was begun about three years ago, under the law of the state limiting to 2½ cents a mile the rates of fare on railroads whose passenger trains earn over $2,000 per mile of road yearly and not more than $3,000. In this case the company claimed that inasmuch as the original company was incorporated and doing business before the passage of the law in question, the present company succeeded to all the rights and privileges of the former company, and that the franchise granted when the articles of association were filed constituted a contract under which the company secured a vested right to charge the rates then fixed by law. The court, however, upheld the law and the position taken by the Commissioner, and the company will now have to make the reduction in rates.

### Business of the Westinghouse Companies.

At the recent annual meeting of the British Westinghouse Company, in London, Mr. George Westinghouse addressed the stockholders on the prospects for the coming year and incidentally gave some information concerning American Westinghouse interests, as follows:

"Under the direction of those connected with our American company, there have been created here in four years a vast plant and business which would have been otherwise impossible or would have required, as in the case of the American company, at least 15 years. There has even then been an unexpected delay ir completion of your plant of fully one year, due to the phenomenal activity of business in America.

"Shipments of your own product began only during this fiscal year, and it is not expected your production will reach a normal condition even this year. Orders in hand not executed on Jan. 31, 1904, were £1,608,256.

"To illustrate capital requirements of such an enterprise, the American Westinghouse companies whose business you are to duplicate have a combined capital of £8,000,000 and their output for the year ending March 31 will exceed £6,000,000. New orders for a long period have equaled output, notwithstanding constant increase in facilities. Running accounts outstanding and material in process and stock aggregate nearly £4,000,000; and percentage of profit on the large capital referred to is greater than when the business was smaller. During the past two years there have been completed new American shops having 60 per cent. of the aggregate capacity of the older works.

"At the Pittsburg Works there have been important developments in simplifying and reducing cost of steam turbine engines; particular attention is being given to a marine type. Great progress has also been made in gas engines. An engine has been perfected which converts soft coal into a producer gas entirely free from tar, which can be cleaned as simply as gas from coke or hard coal. The gas engine will prove the most important instrument for cheap production of power."

### New Ferry Boats for the Erie.

The "Tuxedo," the first of the Erie's three new ferryboats, has arrived and will be placed in service in the Chambers street line. The arrangement in this boat for seating passengers differs from that of any other type of ferryboat. On the inboard side, or next the team gangways, instead of using the fore-and-aft bulkhead seat, double settees butt against the bulkhead, extending out into the cabin. Each of these settees accommodates six persons. A roomy exit is provided. By this arrangement, which is carried out on both decks, seats are provided for 800 persons, 400 on each deck, 250 more than could be arranged for under the old style. There is only one stairway on the boat, and that from the women's cabin to the upper saloon. Under the stairway is provided a women's retiring room. Directly over this stairway there is a bootblack's room, so that the passengers may have their shoes cleaned without going to the main deck. The hull is provided with five watertight bulkheads, with a watertight door in the bulkhead, between the engine room and boilers. The boat's dimensions over all are: Length, 224 ft.; breadth, 65 ft.; depth of hold, 17 ft. It is of the double deck propeller type, with pilot houses on top of the upper saloon, and is propelled by two 18 by 36 by 28 fore-and-aft compound engines, both working on the same shaft. Two Scotch boilers will supply the steam, at a pressure of 150 lbs. The steam dome is laid lengthwise of the boat on top of the deck beams in the center house, connected by pipes to both boilers.

## MEETINGS AND ANNOUNCEMENTS.

*(For dates of conventions and regular mettings of railroad associations and engineering societies see advertising page 16.)*

### The Railway Signal Association.

The Secretary announces that in addition to the subject announced last week for discussion at the meeting of the Association in Chicago, March 8, there will also be presented The Behavior of Automatic Block Signals in Severely Cold Weather.

**Franklin Institute.**

A stated meeting of the Sections was held March 3, at the Hall of the Franklin Institute, Philadelphia. The programme included a paper on Circuit-Breakers, by Wm. M. Scott, and one on The Diaphragm Storage Battery, by J. Hart Robertson.

**The Canadian Society of Civil Engineers of Montreal.**

A meeting of the General Section was held on Mar. 3, at Montreal. The programme included the continuation of discussion on Mr. J. A. Jamieson's paper on Grain Pressure in Deep Bins; also a paper on The Shubenacadie River Bridge, by J. J. Taylor.

**The Engineers' Club of Philadelphia.**

A regular meeting of the Club will be held on Mar. 5. A topical discussion on Conflagrations in Cities will be opened by Dr. Henry Leffmann, with an exhibit of illustrative slides. The discussion will be continued by Mr. William McDevitt and others.

## PERSONAL.

—Mr. W. W. Young, Auditor of Disbursements of the Pullman Company, died suddenly at his home in Chicago, on February 25.

—Mr. George H. Campbell, who has been chosen to succeed Mr. Randolph as General Superintendent of the Baltimore & Ohio in New York City, has been in the railroad service for the past 31 years. He was born at Mendon, Ill., in 1856, and began work at the age of 16 as a telegraph operator on the Chicago, Burlington & Quincy, and for the following four years (1873-1877) he was agent and operator. From 1877 to 1881 he was Chief Clerk on the Wabash. For the six years from 1882 he was on the Missouri Pacific in Texas, four years being spent as agent at Laredo, on the Rio Grande frontier, where the important Mexican traffic was transferred; then one year at Galveston, as Commercial Freight and Passenger Agent, and one year at San Antonio as agent. In 1888 he was appointed Joint Agent at Cincinnati of the Cleveland, Cincinnati, Chicago & St. Louis, the Chesapeake & Ohio and the Louisville & Nashville railroads. In June, 1896, he entered the service of the Baltimore & Ohio as Terminal Agent and Manager of Elevators at Baltimore. Two years later he was appointed Inspector of Stations and Terminals, and in June, 1899, was promoted to be Assistant General Superintendent. In February, 1904, he was again promoted, being made General Superintendent at New York. At the same time he was elected Vice-President of the Staten Island Rapid Transit Railway, which is a B. & O. property.

—Mr. Charles F. Mayer, formerly for about seven years (1888-1895) President of the Baltimore & Ohio, died at Baltimore, Md., on February 24.

—Mr. L. C. Fritch, formerly Superintendent of the Indiana Division of the Baltimore & Ohio Southwestern, and Mr. H. G. Groce, who was in the telegraph department of the same road, are now in the service of the Illinois Central, doing special work.

—Mr. John G. Riley, Master Mechanic of the Western Division of the Michigan Central, died February 21, at his home in Chicago. He was a native of Norwalk, Conn., having been born in that city 69 years ago. Mr. Riley entered the employ of the Michigan Central at Ann Arbor in 1852, and in 1872 was made Master Mechanic at Saginaw. Several years later he was transferred to Chicago as Master Mechanic.

—Colonel Jere Baxter, who was the first President of the Tennessee Central and who held that office until about one year ago, died at his home in Nashville on February 29, after a short illness. Col. Baxter had been prominent in railroad and political circles for many years. He was at one time President of the Memphis & Charleston. He had large interests in industrial affairs, and in 1889 was a candidate for Governor.

—Mr. Tokichi Endo, Chief Engineer of the Nankai Railway of Japan, is in this country studying American railroad practice. He left Japan some months ago and has visited the principal European countries. He will spend the next week or ten days in New York City and, after visits to Washington and Baltimore, will leave here about the end of the month for Buffalo, Niagara Falls, Cleveland, Pittsburg, Chicago and the west. He expects to sail for Japan from San Francisco on May 12.

—Mr. Walter H. Barnes, General Manager of the Boston & Albany, has resigned. Mr. Barnes is one of the veteran railroad men of New England and is well known throughout the country. His entire railroad service has been on the Boston & Albany. Mr. Barnes was born in Worcester, Mass., in 1834, and began railroad work as a delivery clerk in the local freight office at Worcester in 1855. He was steadily promoted through the different grades until in 1882 he was made General Superintendent. In 1887 he was appointed General Manager.

—Mr. Glasenapp, for some years the engineer attaché of the German Embassy in this country, and as such studying and reporting on various technical matters of interest to his government and people, has recently been ordered to Berlin and attached to the railroad department of the Ministry of Public Works. So far as we know, Germany is the only country which maintains an engineer attaché to its embassy, as most countries do military and naval attachés. The explanation is, perhaps, that in Germany more than anywhere else the government builds and conducts public works, railroad and other.

—Mr. George A. Cellar, Superintendent of Telegraph of the Pennsylvania Lines at Pittsburg, was born in Delaware County, Ohio, in 1860. His first railroad work was as an operator and freight clerk on the Pittsburg, Fort Wayne & Chicago at Forest, Ohio, in 1877, and he was operator at various points from then until 1879, when he was transferred as operator at Crestline, where he served until 1884, when he was appointed Manager of the telegraph office at that place. For 19 years following 1885, Mr. Cellar was Chief Clerk to the Superintendent of Telegraph, and in February last was promoted to his new position, that of Superintendent of Telegraph.

—Mr. T. S. Lloyd, whose appointment as General Superintendent of Motive Power of the Chicago, Rock Island & Pacific, is announced, has for the past four years been on the Delaware, Lackawanna & Western. Several years ago Mr. Lloyd went to Kent, Ohio, and was in the shops of the Atlantic & Great Western, now the Erie. Then he became Machinist and later a Foreman on the Toledo & Ohio Central. Previous to going to the Lackawanna Mr. Lloyd was on the Chesapeake & Ohio, and before that he was on the Pittsburg, Fort Wayne & Chicago as Foreman. On the Chesapeake & Ohio he was Master Mechanic at Covington, Ky., and then for about ten years held a similar position at Richmond, Va. He left the Chesapeake & Ohio to go to the Delaware, Lackawanna & Western as Superintendent of Motive Power and Equipment, which position he now leaves to go to Chicago as General Superintendent of Motive Power of the Rock Island.

—Mr. F. N. Hibbits, Assistant Superintendent of Motive Power and Machinery of the Union Pacific, will on March 15, become Consulting Mechanical Engineer of the Southern Railway and its allied lines, including the Queen & Crescent System, the Central of Georgia, the Mobile & Ohio and the Georgia Southern & Florida, in all some 11,500 miles. He will report to a committee, appointed for the purpose, composed of S. Higgins, Mechanical Superintendent of the Southern; James P. McCuen, Superintendent of Motive Power of the Queen & Crescent System; George S. McKee, Superintendent of Motive Power and Car Equipment of the Mobile & Ohio; L. B. Rhodes, Master Mechanic of the Georgia Southern & Florida, and T. S. Moise of the Central of Georgia, the last named to serve until the appointment of a mechanical official. Mr. Hibbits was born in Muncie, Ind., in 1866, and is a graduate of Rose Polytechnic Institute, Terre Haute, Ind. His railroad service dates from 1886, when he began as a machinist and draftsman on the Cleveland, Columbus, Cincinnati & Indianapolis. From 1891 to 1892 he was Engineer of Tests on the New York, Lake Erie & Western, and for the two years following was Mechanical Engineer. In 1894, he was made Master Mechanic of the Rochester Division. From 1895 to 1899 he was Freight Trainmaster of the Erie at Port Jervis, N. Y., and in June, 1899, was promoted to be Superintendent of the Jefferson Division at Carbondale, Pa. Later he resigned from this road to go to the Union Pacific as Mechanical Engineer, and he now leaves the latter road to go to the Southern.

## ELECTIONS AND APPOINTMENTS.

*Bismarck, Washburn & Great Falls.*—E. H. Walker, having resigned, the office of Traffic Manager has been abolished, and all matters pertaining to that department will be handled by the General Superintendent.

*Boston & Albany.*—W. H. Barnes, General Manager, has resigned, effective March 1. The office held by Mr. Barnes has been abolished, and business heretofore addressed to that office will be forwarded to E. Van Etten, Second Vice-President, New York Central & Hudson River Railroad.

*Chicago, Rock Island & Gulf.*—W. G. Bierd has been appointed Superintendent of the Amarillo Division, with headquarters at Amarillo, Texas, succeeding H. P. Greenough.

*Chicago, Rock Island & Pacific.*—T. S. Lloyd, hitherto Superintendent of Motive Power and Equipment of the Delaware, Lackawanna & Western, has been appointed General Superintendent of Motive Power of the C., R. I. & P., with headquarters at Chicago.

E. F. Kearney, hitherto Superintendent of the Terminal Railroad Association of St. Louis, has been appointed Supervisor of Mails of the C., R. I. & P., with headquarters at Chicago.

*Delaware, Lackawanna & Western.*—R. F. Kilpatrick, hitherto Master Mechanic at Scranton, Pa., has been appointed Superintendent of Motive Power and Equipment, with headquarters at Scranton, succeeding T. S. Lloyd, resigned. H. Shoemaker has been appointed to succeed Mr. Kilpatrick. (See Chicago, Rock Island & Pacific.)

*Erie.*—W. S. Haines has been appointed Master Mechanic of the Jefferson and Wyoming Divisions and the New York, Susquehanna & Western Railroad, with headquarters at Dunmore, Pa. T. Rumney succeeds Mr. Haines as Master Mechanic of the New York Division of the Erie, with headquarters at Jersey City, N. J. W. H. Wilson has been appointed Master Mechanic at Susquehanna, Pa. T. J. Cole has been appointed Acting Master Mechanic at Meadville, Pa., and J. Dewey has been appointed Acting Master Mechanic at Galion, Ohio. The headquarters of W. C. Hayes, Assistant Mechanical Superintendent, has been transferred from Meadville, Pa., to 21 Cortlandt street, New York.

Theodore W. Dow has been appointed General Air-brake Inspector, with office at Meadville, Pa.

*Fort Worth & Denver City.*—J. D. Welsh, Superintendent, having resigned, that office has been abolished. G. W. Rourke has been appointed Assistant Superintendent, with headquarters at Childress, Texas.

*Houston & Texas Central.*—C. C. Barry has been appointed Auditor, with headquarters at Houston, Texas, succeeding W. C. Parker, resigned.

*Michigan Central.*—The jurisdiction of E. R. Webb, Division Master Mechanic at Michigan City, Ind., has been extended over all Locomotive department affairs in the Chicago District. William Rourk has been appointed Car Foreman at Chicago, succeeding J. G. Riley, deceased, and William Cunningham succeeds Mr. Rourk as Car Foreman at Detroit Station. Mr. Cunningham in turn is succeeded by John T. Downs as Car Foreman at Jackson.

*New York, New Haven & Hartford.*—William E. Chamberlain, General Manager, with headquarters at New Haven, has resigned, to take effect about April 1.

J. I. Vernon, Acting Signal Engineer, has changed his headquarters from Bridgeport, Conn., to Boston, Mass. His office is in the South Terminal Station.

*Norfolk & Western.*—George P. Johnson, hitherto Superintendent of the Shenandoah Division at Roanoke, has been appointed Superintendent of the Scioto Valley Division, with headquarters at Portsmouth, Ohio, succeeding J. B. Conners, resigned.

*Pennsylvania.*—The jurisdiction of R. N. Durborow, Superintendent of Motive Power of the P. R. R. Division, has been extended to include a number of short sections of the New York Division and of the Philadelphia, Baltimore & Washington Railroad, in Philadelphia.

*San Pedro, Los Angeles & Salt Lake.*—The jurisdiction of I. O. Rhoades, General Purchasing Agent of the Oregon Short Line, has been extended over the S. P., L. A. & S. L.

*Southern.*—F. N. Hibbits, hitherto Assistant Superintendent of Motive Power and Machinery of the Union Pacific, has been appointed Consulting Mechanical Engineer of the Southern, and its affiliated lines, effective March 15.

The line from Savannah to Jacksonville (not including Savannah terminals) will be known as Jacksonville Division, with W. L. Williamson, Superintendent, with headquarters at Jacksonville, Fla., in charge. P. L. McManus has been appointed Assistant Superintendent of the Charlotte Division, with headquarters at Charlotte, N. C.

*Temiskaming & Northern Ontario.*—Robert Jaffray, of Toronto, has been chosen Chairman of the Board of Commissioners which is provided for under the law by which this railroad is being built as a government enterprise.

*Terminal Railroad Association of St. Louis.*—I. L. Burlingame, hitherto Assistant Superintendent, has been appointed Superintendent, succeeding E. F. Kearney, resigned. F. E. Bentley has been appointed Superintendent of Telegraph, with office at St. Louis, succeeding S. C. Shaw. (See Chicago, Rock Island & Pacific.)

*Toledo, St. Louis & Western.*—C. D. Whitney, General Traffic Manager at Toledo, Ohio, has resigned. It is said that Mr. Whitney retires to go into private business.

*Union Pacific.*—F. N. Hibbits, Assistant Superintendent of Motive Power and Machinery, has resigned. (See Southern.)

*Western Maryland.*—Lawrence Greer has been appointed General Counsel, with headquarters at No. 120 Broadway, New York.

## LOCOMOTIVE BUILDING.

*The Silverton Northern* is having one locomotive built at the Baldwin Works.

*The Minneapolis, St. Paul & Sault Ste. Marie* is in the market for some locomotives.

*The Detroit Southern* is having four locomotives built at the Baldwin Locomotive Works.

*The Missouri, Kansas & Texas* has ordered ten locomotives from the American Locomotive Company.

*The Chicago, Milwaukee & St. Paul* is reported to be about to place an order for a large number of locomotives.

*The Miller Plantation Co.*, Mexico, has ordered one 21-ton, narrow gage locomotive from the Davenport Locomotive Works, Davenport, Iowa.

*The Cerro de Pasco Copper Mine Co.*, Cerro de Pasco, Peru, has ordered four standard gage switching engines from the Davenport Locomotive Works, Davenport, Iowa.

## CAR BUILDING.

*The Baltimore & Ohio* is in the market for three dining cars.

*The Northern Pacific* is in the market for 22 passenger coaches.

*The Illinois Central* has ordered one dining car from Barney & Smith.

*The Gulf & Ship Island* is reported to be in the market for 800 freight cars.

*The Missouri, Kansas & Texas* has ordered 2,000 coal cars from the Pullman Co.

*The St. Louis & San Francisco* is reported in the market for 20 passenger coaches.

*The Illinois Tunnel Co.* will ask for bids about March 15 for 2,000 steel freight cars.

*The New York Central & Hudson River* is having five coaches built by the Pullman Co.

*The Potosi & Rio Verdi* has ordered 30 flat cars from the American Car & Foundry Co.

*The Colorado & Southern* has ordered 1,200 box and stock cars from the American Car & Foundry Co.

*The Baltimore & Ohio* denies being in the market for passenger coaches, as reported in our issue of Feb. 26.

*The Wilcox-Ives Oil Co.* has awarded a contract for a number of tank cars to the Georgia Car & Manufacturing Co.

*The Atlantic & Birmingham* is having nine coaches built at the Wilmington Works of the American Car & Foundry Co.

*The Cherokee Construction Co.* has ordered for the Midland Valley 50 36-ft. standard box cars of 60,000 lbs. capacity, from the Mt. Vernon Car Manufacturing Co., to be built of wood and metal, with wooden underframes. The special equipment includes: Block-Pollak Iron Co.'s axles, Simplex bolsters and brake beams, Mt. Vernon Car Mfg. Co.'s brake shoes and wheels, National-Fulton brasses, Tower couplers, Western Railway Equipment Co.'s doors, Miner draft rigging, malleable journal boxes, Sherwin-Williams paint, Excelsior roofs and Pittsburg Spring & Steel Co.'s springs.

*The Rutland* has ordered two postal cars from the Wilmington shops of the American Car & Foundry Co., for June delivery. The cars will be 51 ft. long over end sills, 9 ft. wide and 13 ft. 3½ in. high. The special equipment includes: Otis steel axles, sandwich bolsters, National-Hollow brake-beams, American Brake Shoe & Foundry Co.'s brake shoes, Westinghouse air-brakes, Magnus Metal Co.'s brasses, Gould couplers, Harrison dust guards, Gold steam-heating system, Pressed Steel journal-box lids, Pintsch gas, Murphy paint, Standard Steel platforms, Railway Steel-Spring Co.'s springs and Paige steel-tired wheels.

*The Southern* is in the market for 25 first class coaches, to weigh about 108,000 lbs., and measure 66 ft. long, 9 ft. 10¼ in. wide and 14 ft. 1¼ in. high, over all. The special equipment will include: open-hearth steel axles, Diamond special brake-beams, Westinghouse air-brakes, Ajax brasses, Janney-Buhoup couplers, Forsyth curtain fixtures, Pantasote curtain material, Miner draft rigging, Harrison dust guards, Gold steam heating system, McCord journal boxes and lids, Pintsch gas, Standard Coupler Co.'s steel platforms, Railway Steel-Spring Co.'s springs, Southern Railway Co.'s six-wheel trucks, Buhoup vestibules and McKee-Fuller Co.'s wheels.

*The Canadian Pacific*, as reported in our issue of Feb. 19, is building five dining cars and 15 sleeping cars at its shops at Hochelaga, Que. The dining cars will weigh 114,000 lbs. and will be 72 ft. long, 9 ft. 10½ in. wide over frame, and 15 ft. 7½ in. high. The sleeping cars will weigh 112,000 lbs. and will be 72 ft. long, 9 ft. 10½ in. wide and 14 ft. 8 in. high. Special equipment for both includes: National-Hollow brake-beams, Canadian Pacific Ry. 8-in. plate bolsters, Westinghouse-American air-brakes, St. Thomas Brass Co.'s brasses, Tower couplers, National curtain fixtures, Fabrikoid curtain material, Blount door fasteners, Ryan dust guards, Miner draft rigging, Gold heating system, M. C. B. cast-iron journal boxes, acetylene gas, Canada Paint Co.'s paint, Standard steel platforms, Pullman seats, Montreal Steel Co.'s springs, six-wheel trucks, and Pullman wide vestibules.

*The Chicago, Milwaukee & St. Paul* is about to build six combination mail and express, five mail, five baggage and a number of stock cars. The combination cars will weigh 74,500 lbs., the mail cars will weigh 81,200 lbs., and the baggage cars will weigh 70,700 lbs.; and combination, mail and baggage cars will measure 60 ft. long, 9 ft. 3 in. wide and 10 ft. high, all inside measurements. The stock cars will weigh 29,400 lbs., and measure 36 ft. 2½ in. long, 8 ft. 7½ in. wide and 7 ft. 5½ in. high, all inside measurements. The special equipment for all will include: National-Hollow brake-beams for combination, mail and baggage cars; Congdon brake-shoes, New York air-brakes, Hennessey draft rigging for stock cars, Pressed steel journal-box lids for combination, baggage and stock cars; C., M. & St. P. standard paint and wheels, Pullman six-wheel trucks for combination, mail and baggage cars, and Barber four-wheel trucks for stock cars.

## BRIDGE BUILDING.

ALABAMA.—The bill authorizing the Mobile & West Alabama Ry. Co. to build a bridge across the Warrior River, in Tuscaloosa Co., Ala., was passed by the U. S. Senate on Feb. 26. (Feb. 5, p. 103.)

The bill authorizing the Mobile & West Alabama Ry. Co. to build a bridge over the Tombigbee River, between Clarke and Choctaw counties, Ala., was passed by the U. S. Senate on Feb. 24. (Feb. 5, p. 103.)

ALLISON, IOWA.—Butler County Board of Supervisors has been petitioned to build a wagon bridge over the Shellroch River, at Lowell.

AMSTERDAM, N. Y.—A bill has been introduced at Albany appropriating $14,500 for building a bridge over the Erie Channel at Amsterdam.

ATKINSON, NEB.—Petition has been made for a bridge to be built jointly by the counties of Holt and Bird, at Dodge Ferry.

ATLANTA, GA.—A steel and stone viaduct is proposed over the railroad tracks and Ella street, a distance of 240 ft., at a cost of about $75,000. Plans have been made by Captain R. M. Clayton, City Engineer.

Bids are wanted, March 31, for building a bridge over the Chattahoochee River, near Atlanta. H. E. W. Palmer is Commissioner of Roads and Revenue.

AUSTIN, TEXAS.—The International & Great Northern, it is reported, will build a new bridge over the Colorado River.

BANGOR, ME.—Mayor Beal is interested in the project to build a bridge over Kenduskeag stream from the foot of Water street to Washington street; also of a steel toll bridge to replace the present structure over the Penobscot River, at a total cost of about $150,000.

BARRIE, ONT.—The County Council has decided to build a new steel bridge over the Severn River to replace Bennett Bridge, the Ontario Government having promised to pay $5,600, half of the cost.

BELLEPLAINE, KAN.—It is proposed to rebuild the bridge over the Ninnescah River near this place. It is to have three iron spans on concrete piers.

BLOOMSBURG, PA.—The Danville & Bloomsburg Electric Ry. Co. will soon ask bids for its new bridge over Fishing Creek.

BROOKSVILLE, IND.—The Board of County Commissioners is making plans for building a concrete or iron bridge to be 150 ft. long, of two spans or arches, over Flat Rock at the Brooksville Road. J. W. Craig is engineer in charge.

CINCINNATI, OHIO.—The Liberty street viaduct will probably be replaced by a new structure.

CLIFTON HEIGHTS, PA.—A new bridge will be built over Darby Creek at Kent's Mill to replace the structure recently carried away by floods.

COLUMBUS, OHIO.—Bids are wanted, March 17, by the Board of Franklin County Commissioners for a large amount of bridge work. L. E. Jones is County Auditor.

The County Commissioners will build bridges over Alum and Big Walnut Creek at a cost of about $22,000.

CONNELLSVILLE, PA.—Viewers have been appointed to select a site for the proposed county bridge over Dunbar Creek, in Dunbar Township.

DANVILLE, PA.—The Grand Jury has recommended the building of a county bridge over Beaver Creek, in Blindstone Township.

DARBY, PA.—The County Commissioners will be asked to build a bridge over the creek at Chester avenue.

DERBY, CONN.—Bids are wanted, March 25, by the Bridge Committee for building a Melan arch bridge, 329 ft. 6 in. long and 54 ft. wide, over the Naugatuck River. Mayor George P. Sullivan is chairman of the committee. Plans are at the office of the Concrete Steel Engineering Co., Consulting Engineers, New York.

DESERONTO, ONT.—The Bay of Quinte Ry. will build four steel bridges on an extension of its line from Tweed to Bannockburn. Two of the bridges will be plate girders 60 ft. and 90 ft. respectively, and the other two will be through truss spans of 120 ft. and 140 ft. each. J. W. Evans is Chief Engineer.

DETROIT, MICH.—The Detroit, Monroe & Toledo Short Line Railway Co. has plans ready for building a steel railroad bridge over Rouge River, in Wayne County. It is to be a through-swing, truss-span, with a center pivot pier of concrete construction. Matthew Slush, Hammond Building, Detroit, is President.

FALLS CITY, NEB.—Bids are wanted, April 13, by J. C. Tanner, County Clerk, for some bridge work.

FREMONT, NEB.—Bids are wanted, March 22, by C. O. Boe, County Clerk, for building all the bridges needed in Dodge County during 1904.

GLENBROOK, CONN.—The towns of Stamford and Darien are having plans made for a masonry arch bridge over Noroton River, at Glenbrook. H. A. Parsons, of Stamford, is engineer in charge.

GRANTVILLE, KAN.—A new bridge is proposed over the Kansas River, to be built jointly by Shawnee and Jefferson counties, at an expense of about $30,000.

GUTHRIE, OKLA. T.—The Board of County Commissioners intend to build the following bridges: One of 140 ft., one of 120 ft. and three of 100 ft. each. C. H. Griswald is Chairman of the Board.

HALIFAX, N. S.—Plans are ready for building an overhead bridge at Kempt road, to carry the Halifax & Southwestern Ry. into Halifax. T. H. White, Bridgewater, N. S., is Chief Engineer.

HUNTINGTON, IND.—Bids will be asked next month by the County Commissioners for building the Geiger and Johnson bridges in Rock Creek Township and the Hosler bridge in Union Township.

HYDE PARK, MASS. Residents of West Roxbury and Hyde Park are urging the Railroad Commission to authorize the work of extending Metropolitan avenue over the tracks of the New York, New Haven & Hartford, near Clarendon, in the town of Hyde Park, at a cost of about $55,000.

INDIANA.—A bill authorizing the Southern Indiana Ry. Co. to build a railroad bridge across the Wabash River, in Vigo County, Ind., has been introduced in the U. S. Senate.

INDIANA, PA.—Viewers have been appointed to select the site for a new county bridge over Crooked Creek, at Grafts Mill.

INDIANAPOLIS, IND.—Separate bids are wanted March 14 by the Board of Marion County Commissioners for the following bridge work: A bridge on White River and Fall Creek road south of Fall Creek, in Washington Township; two bridges over Buck Creek, in Perry Township; a bridge over Buck Creek on a line between Perry and Franklin Townships, and a bridge over Bean Creek at Keystone avenue, in Center Township. John E. McGaughey is Commissioner.

KANSAS CITY, MO.—The River Commission has recommended the passage of an ordinance requiring all bridges over the Kaw River to be above the flood mark of 1903; also that piers be at least 300 ft. apart.

LITCHFIELD, MINN.—Bids are wanted, March 9, for building a 100-ft. steel bridge over the Crow River. J. N. Gayner is County Auditor.

MILWAUKEE, WIS.—The bids received for building the Bartlett street bridge over the tracks of the Northwestern R. R. were: Milwaukee Bridge Co., $22,500; Frank Skobis, $25,718; F. Poetsch, $43,352; Wisconsin Bridge & Iron Co., two bids, $26,221 and $25,900; American Bridge Co., $27,960, and Worden-Allen Co., $25,742.

MINNEAPOLIS, MINN.—The Brown's Creek Bridge will be jointly rebuilt by the city, the county and the Northern Pacific R. R. Co.

MORRISTOWN, TENN.—A steel bridge is to be built over the creek on Main street.

NEWPORT, R. I.—An act will be introduced in the State Legislature providing for an appropriation of $100,000 to build a new swing drawbridge at Howland's Ferry. The Government has appropriated $40,000 for widening and deepening the channel at this point. Chas. Alexander is one of the Commissioners.

NORFOLK, VA.—The Norfolk & Berkeley Bridge Co. has petitioned the Secretary of War for permission to build a drawbridge about 1,600 ft. long, with an opening of 48 ft., over the east branch of the Elizabeth River.

ORANGE, CONN.—New Haven and Orange may jointly issue bonds to cover the cost of 10 drawbridges and deepening and widening West River.

OSHKOSH, WIS.—The Council has been petitioned to build a new bridge over the Fox River at Main street, to cost about $100,000.

PHILADELPHIA, PA.—Plans have been completed for the double-deck Market street bridge over the Schuylkill River for the Philadelphia Rapid Transit Co., at a cost of about $1,000,000. Bids will be asked about March 15.

PHOENIX, ARIZ.—The Phoenix & Eastern R. R. will build two steel bridges over the Gila River.

PITTSBURG, PA.—An additional $40,000 will be added to the amount already provided for the Wilmot street bridge, making a total of $138,263. Appropriations were made for repairs to the Forward avenue bridge, the Spahr street footbridge and the bridge over the Pennsylvania tracks on Center near Morewood avenue.

PORT ARTHUR, TEXAS.—The Board of County Commissioners is having plans made for a drawbridge to be built over Taylor's Bayou. County Judge D. P. Wheat, of Beaumont, can give information.

RICHMOND, IND.—The Columbus, Greensburg & Richmond Traction Co. has offered to pay $20,000 towards the cost of building a bridge over White Water River in the southern part of the state, but the bridge will cost about $100,000, and the County Commissioners will ask the railroad to pay at least one-third of the total cost.

RIVERSIDE, CAL.—The city will contribute about $85,000 and the Riverside Water Co. the balance for building a concrete bridge over Jurupa avenue.

SALT LAKE CITY, UTAH.—The City Council has been petitioned to at once build a steel viaduct over 24th street from Wall avenue to Weber River, a distance of three-fourths of a mile.

SCHENECTADY, N. Y.—Plans for the proposed railroad grade crossing abolition work have been submitted to the State Railroad Commission. The cost is estimated at about $1,000,000. An appropriation of $75,000 was made last year to begin the work, and a bill for an additional $175,000 will shortly be introduced in the Legislature.

SCRANTON, PA.—The County Council has passed the ordinance to issue $60,000 of bonds for building bridges at Ash street, Albright avenue and Sanderson avenue.

SHARON, PA.—The Sharpsville Bridge, recently destroyed by a flood, will be rebuilt by the state. The viewers appointed by the Dauphin County Court have reported favorably on the question of building Hazel street viaduct.

SPOKANE, WASH.—The Oregon Railroad & Navigation Co. has agreed to the building of a viaduct over its tracks at Washington street.

TIVERTON, R. I.—An act has been introduced in the Assembly authorizing a new bridge over the Seaconnet River at Tiverton to replace the old stone structure, at a cost of about $100,000.

TOWANDA, PA.—The court has been petitioned to build a bridge about 1,200 ft. long over the Susquehanna River and Lehigh Valley tracks at North Towanda.

WINNIPEG, MAN.—Plans for the proposed Canadian Pacific Railway subway have been submitted to the City Council.

WASHINGTON, D. C.—Contract was let last week for completing the proposed new bridge over Rock Creek on the line of Connecticut avenue. This bridge was designed by the late George S. Morison. The foundations are already completed and $650,000 is available for the superstructure. Bids were submitted under two designs: "A" for a bridge entirely of stone, and "B" for a seven-span masonry structure of concrete construction below the coping. There were five bidders. The contract was let to the District Construction Company, of Washington, D. C., the lowest bidder at $597,594.88 on design "B," none of the bids under design "A" being within the amount available. The specifications require that the bridge shall be completed by Jan. 1, 1907, and the total cost of the bridge, including the foundations, will be $800,000.

YANKTON, S. DAK.—The U. S. Senate on Feb. 24 passed a bill authorizing the Yankton, Norfolk & Southwestern Ry. Co. to build a combined railroad, wagon and foot-passenger bridge across the Missouri River, at or near Yankton, S. Dak., the plans, location and operation of the bridge to be subject to the approval of the Secretary of War.

YORK, PA.—The county will build a new bridge connecting Farm and Hopewell townships, to replace the structure recently carried away by high water.

### Other Structures.

ATLANTA, GA.—The Louisville & Nashville, it is reported, has let a contract to Cook & Laurie, of Montgomery, Ala., for building its $80,000 roundhouse at Inman Park. This practically insures the location in Atlanta of the L. & N. terminals.

AUSTIN, TEXAS.—The Railroad Commission has been petitioned to compel the International & Great Northern to build passenger stations at Penelope and Walling.

BAYONNE, N. J.—The Goubert Manufacturing Co., of New York City, will build new works at Bayonne. A new foundry, 70 x 310 ft., three other buildings each 60 x 310 ft., and a number of others will be built.

CAMBRIDGE CITY, IND.—The Cleveland, Cincinnati, Chicago & St. Louis and the Lake Erie & Western are considering building a new station at this place.

DECATUR, ALA.—The Southern and Louisville & Nashville are jointly making surveys and preparing plans for building a stone or brick passenger station.

DURHAM, N. C.—The Durham Iron Works Co. is being organized by A. P. Gilbert and will build a foundry 50 x 100 ft., also some other shops.

HOBOKEN, N. J.—The Delaware, Lackawanna & Western is making plans to build passenger car repair shops near Hoboken.

HOPKINSVILLE, KY.—The Louisville & Nashville, it is reported, will build a new freight house.

NEWCASTLE, IND.—A new union passenger station is to be built by the Pittsburg, Cincinnati, Chicago & St. Louis and the Lake Erie & Western, on which work will begin about May 1.

OKLAHOMA CITY, OKLA. T.—The Oklahoma Foundry & Machinery Co., recently organized, will move its Texarkana foundry and machine works to this city. New buildings will soon be put up.

OMAHA, NEB.—A large new freight house of brick and stone, reports say, will be built on the Chicago Great Western terminals, to cost, with other improvements, about $150,000.

The Chicago, Burlington & Quincy is considering plans for a new freight house.

RED WING, MINN.—The Milwaukee road will build a new passenger station to cost about $20,000.

SPRINGFIELD, OHIO.—The Rodgers Iron Co. is making plans for building a new foundry early in the spring.

TRENTON, N. J.—The Pennsylvania R. R., it is reported, has bought a large plot of ground on which it will build a new freight station.

TYLER, TEX.—The Railroad Commission has directed the St. Louis Southwestern to build a new passenger station at Tyler within six months.

VIRGINIA, MINN.—The Great Northern, it is reported, will build a new passenger station at the foot of Central avenue.

WILMINGTON, DEL.—The Hilles & Jones Co. will build a foundry 123 ft. x 200 ft. on a concrete foundation, at Ninth and Locust streets.

## RAILROAD CONSTRUCTION.

### New Incorporations, Surveys, Etc.

ARIZONA SOUTHERN.—It is reported that the contract for grading this line from Red Rock, Ariz., south to the mines of the Imperial Copper Co., 21 miles, has been let to Grant Bros. Connection will be made with the Southern Pacific at Red Rock. E. B. Gage and W. F. Staunton are incorporators. (Feb. 12, p. 119.)

BIRMINGHAM, COLUMBUS & ST. ANDREWS BAY.—Work will be started about April 1 on this proposed railroad from Birmingham, Ala., via Columbus, Ga., to St. Andrews Bay, Fla., 360 miles. Grading will first be begun between Chipley, Fla., and St. Andrews Bay, 50 miles, and the line will then gradually be extended northwest through the state of Georgia to Birmingham. L. E. Miller, Philadelphia, has the general contract for building. W. Miller Gordon, Columbus, Ga., is President. (June 19, p. 449.)

CALIFORNIA ROADS.—The Eldorado Lumber Co. has let a contract to Carney, Ray & Carney for building an extension of its main line from Placerville northeast, 10 miles, to lumber mills owned by the company. Work will be begun at once, and the contract calls for the completion of the line before the fall.

CANANEA, YAQUI RIVER & PACIFIC.—Press reports state that this company is making surveys for a proposed extension from Globe, Ariz., to coal fields in the northern part of Arizona.

CEDAR FALLS & NEW HARTFORD (ILLINOIS CENTRAL).—The branch line which this company is building from Cedar Falls, Iowa, west to New Hartford, seven miles, has been completed for a distance of three miles. Lorimer, Gallagher & Walsh, Chicago, are the contractors. (April 10, p. 274.)

CHICAGO, ROCK ISLAND & PACIFIC.—It is reported that work will be begun about April 1 on the extension from Winterset, Ia., west to Greenfield, 26 miles. Grading was begun on this line in October, 1903; but, after eight miles had been graded, the work was discontinued. (Oct. 23, p. 768.)

CHIHUAHUA & PACIFIC.—Contracts for grading the proposed branch of this road from El Carpio to Temosachic, 52 miles, will be let about April 1. The line has already been located. H. W. Edwards, Chihuahua, Mex., is Chief Engineer. (Oct. 23, p. 768.)

CINCINNATI, BLUFFTON & CHICAGO.—An officer writes that surveys have been completed for the entire line from Huntington, Ind., to Union City, 70 miles. Twenty miles of line have been completed between Bluffton and Pennville. Work will be begun in the spring on the remainder of the line from Pennville to Union City and from Bluffton to Huntington. The Bracey-Howard Construction Co. has the contract for building the road. A. T. Russell, Bluffton, Ind., is Chief Engineer. (Jan. 8, p. 34.)

COAL & COKE.—Bids will be received until March 10, at the office of the Chief Engineer of this company at Weston, W. Va., for grading and masonry work on 30 miles of single track between Frenchton, in Upshur County, and the mouth of Copen Run, in Braxton County. A. A. Chapman is Chief Engineer.

DAYTON, UNION & HUNTINGTON.—It is stated that work will soon be begun on this proposed line from Union City, Ind., to Huntington, 70 miles. It is said that the work will include the following: Seven stations, one roundhouse, one repair shop, one 400-ft. iron bridge, one wooden trestle 1,300 ft. long, and 450,000 cubic yards of embankment. James Williams, Columbus, Ohio, is Chief Engineer. E. E. Perry, Indianapolis, Ind., may also be addressed.

DENVER, NORTHWESTERN & PACIFIC.—This company has completed its road for a distance of 23 miles. Grading has been finished as far as Boulder Park, 47 miles from Denver, and work is now in progress between Boulder Park and Hot Sulphur Springs, Colo., 53 miles. The entire line from Denver to Salt Lake City will be 540 miles long and location surveys are practically completed. H. A. Sumner, Denver, Colo., is Chief Engineer.

HUNTINGTON & CHARLESTON.—A charter has been granted this company in West Virginia to build a railroad from Huntington to Charleston, 45 miles. The proposed line will parallel the Chesapeake & Ohio between these points. W. R. Thompson, T. J. Bryan, A. E. Bush and others, of Huntington, W. Va., are incorporators.

INTERCOLONIAL.—Bids will be received until March 14 at the Chief Engineer's office, at Moncton, N. B., for work in connection with the double-tracking of the main line between Bedford, N. S., and Windsor Junction, five miles.

JENNINGS & NORTHERN.—Press reports state that a contract has been let for building this railroad from Jennings, La., northwest to Natchitoches, 100 miles. E. F. Rowson, Jennings, La., is President. (Sept. 18, p. 680.)

KANAWHA, GLEN JEAN & EASTERN.—Bids are now being received by this company for building an extension from Thurmond, W. Va., to Kilsyth, 11 miles. Surveys for this extension have already been completed. Thomas Nichol, Kilsyth, W. Va., is Chief Engineer. (Jan. 22, p. 72.)

KETTLE VALLEY.—Application will be made at the next session of the Dominion Parliament for an act authorizing extensions of this road from a point on the Kettle River, via Nicola, to Spences Bridge, and also from the Kettle River to Killarney. J. R. Stratton, Provincial Secretary of Ontario, is President of the road.

MANISTEE & NORTH EASTERN.—This company has completed 15 miles of its extension from Kaleva to Gibbs Mills, Mich., 25 miles. The remaining 10 miles from Glengarry to Gibbs Mills is now being graded. (Dec. 11, p. 826.)

MEADOW CREEK.—A charter has been granted to this company in West Virgina to build a line from a connection with the Chesapeake & Ohio, at the junction of the Gauley and New rivers, southeast to Ronceverte, W. Va., 50 miles. R. A. Gorham, R. W. Boyden and F. A. Beckford are incorporators.

MERIDA & PETO.—A concession has been granted this company by the Mexican Government with power to build and operate a railroad from Hunabchen southeast to Teabo, 43 miles. Under the terms of the concession, work must be begun at once and five miles must be completed the first year.

MEXICAN ROADS.—A concession has been granted by the Mexican Government to Wenceslao Garcia to build a railroad from Oaxaca east to Tlacolula, 20 miles, with several branches. By the terms of the concession, surveys must be begun at once and the road must be completed within three years.

The San Luis Mining Co. is about to build a narrow gage railroad three miles long from a point near Panuco de Coronado, in the state of Durango, Mex., to its mines. The road will eventually be extended 12 miles to connect with the Mexican International at Gabriel.

The Cieneguita Mining Co. is making surveys for a road from its mines at Cieneguita, Mex., to Minas Prietas, approximately 100 miles.

MONTANA R. R.—Surveys are now in progress for a revision of the location and grade of the line between Lombard, Mont., and Freeman, 40 miles. By the new line several heavy grades between these points will be done away with. The road is now in operation between Lombard, Mont., and Lewiston, 156 miles. P. T. Robertson, Lombard, is Chief Engineer. (Jan. 8, p. 34.)

MORELIA & TACAMBARO.—Grading is in progress on this road, which is projected from Iraquato, Mexico, south via Morelia to Tacambaro, 123 miles. A subsidy of $3,000 per kilometer has been granted and it is stated that the road will be built as rapidly as possible. A. J. Peyton, 69 Wall street, is interested. (Dec. 4, p. 878.)

NATCHEZ, RED RIVER & TEXAS. It is stated that surveys are now being made for reballasting and changing the gage of the main line of this road from Vidalia, La., to Trinity. The road is narrow gage and is to be made standard. It is also stated that the name will be changed to Natchez & Western, and that an extension will be built to Jena, La.

NATIONAL OF MEXICO.—It is reported that grading has been completed on the new branch line of this company from Monterey to San Miguel, 75 miles. Track laying is to be begun at once, and it is stated that line will be ready for operation in about six months. Connection will be made at San Miguel with a short railroad from Matamoros which belongs to the National of Mexico (Feb. 5, p. 104.)

NEWPORT & SOUTH SHORE.—It is stated that the belt line which this company has been building between Cleveland, Ohio, and Newburg, five and one-half miles, will be open for traffic on May 1. A chief business of the road will be to carry metal and coke from the various railroads running into Cleveland to the plants of the American Steel & Wire Co. (April 24, p. 304.)

NEW YORK CENTRAL & HUDSON RIVER.—Bids will be received until March 10 for building a second track and siding between Mount Kisco and Goldens Bridge, 7 miles, on the Harlem Division; also for changes of grade and widening of portions of the roadbed between Goldens Bridge and Purdy's, 2½ miles.

Bids will be received until March 14 for some double-track work and grade revisions and yards on the Pennsylvania Division.

NIAGARA TRANSFER.—Articles of incorporation have been filed by this company in New York. It is proposed to build from Buffalo to Tonawanda, 10 miles. Maps of the route were filed with the County Clerk last September. J. C. Conway, T. C. Becker, H. C. Howard and others, of Buffalo, are incorporators. (Sept. 4, p. 642.)

OKLAHOMA CITY & NORTHWESTERN.—Press reports state that this company is about to be organized in Oklahoma to build a railroad from Oklahoma City northwest to Denver, Colo. It is stated that A. E. Stillwell, Kansas City; C. G. Jones, Oklahoma City; E. L. Peckham, and others, are interested.

SOUTHWESTERN OF LOUISIANA.—The newspapers say that work will soon be begun on this proposed line from Natchitoches, La., to Crowley, 120 miles. G. E. Montgomery is President, J. W. Freeman Vice-President, and C. N. Cunningham Secretary, all of Natchitoches, La.

SUWANEE & SAN PEDRO.—An officer writes that this company has prepared plans for an extension of its line from Perry, Fla., to Monticello, and thence west to Tallahassee, 50 miles. Connection will be made with the Tallahassee Southeastern at Tallahassee, and with the Plant System at Monticello. Frank Drew, Live Oak, Fla., is President, and R. N. Ellis, Jr., is Chief Engineer. (Feb. 26, p. 152.)

TIDEWATER R. R.—A charter has been granted this company in Virginia. It is proposed to build from a point in the southern part of Virginia through coal fields in West Virginia to a point near the mouth of the James River. The headquarters of the company will be at Staunton, Va. T. D. Ranson is President, W. H. Landes Vice-President, and J. B. Ranson Secretary.

TOBIQUE VALLEY.—Application will be made at the next session of Parliament for an extension of time for the completion of this line. The road runs at present from Perth Center to Plaster Rock, N. B., 28 miles, and is leased to the Canadian Pacific. It is proposed to extend the line from Plaster Rock along the Tobique River Valley for a distance of 10 miles.

UINTAH R. R.—It is stated that contracts for grading the remainder of this line will be let in the near future. The proposed route is from Crevasse to the state line between Colorado and Utah near Evacuation Creek, 52 miles. Grading is now in progress on the first 11 miles by the Utah Construction Co. C. U. Baxter, of Denver, Colo., is General Manager. (Jan. 15, p. 54.)

WADLEY & MT. VERNON.—It is stated that this company will soon begin work on an extension from Douglas, Ga., southwest through Clinch and Sirmans to Milltown, 40 miles. Surveys are reported in progress.

WINNISBORO GRANITE R. R.—Press reports state that this company will soon begin work on an extension from Rion, S. C., southwest to Alston, 10 miles. B. H. Heyward, R. G. Rhett and T. M. Waring are interested.

WYOMING ROADS.—Press reports state that the Kemmerer Coal Co. is making surveys for a railroad from Kemmerer, Wyo., north to its coal mines, a distance of eight miles.

## GENERAL RAILROAD NEWS.

ATLANTIC & NORTH CAROLINA.—V. E. McBee has been appointed receiver of this road, upon the petition of K. S. Finch, of Charlotte, N. C. It is stated that an effort will be made on the part of the minority stockholders to have the receivership vacated.

CHICAGO & WESTERN INDIANA.—This company has leased to the Chicago & Eastern Illinois its freight terminal grounds in Chicago, bounded by Twelfth, Taylor and Clark streets. By the terms of the lease, the Chicago & Eastern Illinois pays a fixed rental and $\frac{1}{12}$ of the 4 per cent. interest on the $2,582,000 consolidated bonds of the Chicago & Western Indiana, which were originally issued by the latter company to pay for this property. The lessee must also pay the cost of all extensions and improvements on the property.

DENVER, LAKEWOOD & GOLDEN.—This road, which runs from Denver, Colo., to Golden, 13 miles, will be sold at foreclosure sale on April 21. The foreclosure proceedings are the result of failure on the part of the company to pay the interest on its bonds. The amount due is stated to be $1,116,000.

DES MOINES & FORT DODGE (C., R. I. & P.).—The control of this road has been bought by a syndicate represented by E. S. Hooley & Co., 30,000 shares of the common stock being taken. The line of the road runs between the two cities named, a distance of 88 miles, with a branch from Tara, Iowa, to Ruthven, 55 miles. The outstanding capital stock is $4,283,000 of common and $763,500 of preferred. This road has been operated by the Rock Island under lease for 17 years, but this lease expires in 1905.

ERIE.—It seems to be generally admitted that this company will on May 1 again be placed in control of the voting trustees whose term of office has expired owing to the second payment of a 2 per cent. dividend on the first preferred stock. The following letter was recently issued by the voting trustees: "In view of the present situation, the holders of important interests in the property have strongly urged us to arrange for an extension of the voting trust for a further period of five years, during which it is hoped that most of the important developments of the property which are now in contemplation can be completed. Inasmuch as the earnings of the property have now reached a point where the dividend, upon which the continuation of the voting trust was limited, could be safely paid, we have felt that our obligation had been fulfilled, and that we were entitled to be relieved from further responsibility. Considering, however, the urgency of the request, we have deemed it our duty to bring the matter to the attention of the present holders of the stock trust certificates." It is stated that the majority of the stockholders desire to have the voting trust extended for another five years. The votes on this question will be received at the office of J. P. Morgan & Co. until May 1, 1904.

FAIR HAVEN & WESTVILLE.—See New York, New Haven & Hartford below.

NEW YORK & JERSEY (TUNNEL).—Pres. Wm. G. McAdoo denies that the tunnel which he is building under the Hudson River will be used by the Erie or Lackawanna. The tunnel is strictly for the use of light electric cars and is being built to connect the city surface lines in Jersey City with those in New York. For description of tunnel, see our issue of Nov. 27, p. 840.

NEW YORK CENTRAL & HUDSON RIVER.—This company has borrowed $5,000,000 from New York banks on notes which are said to run for a year and which will bear 4½ per cent. interest. It is stated that the money is required because the earnings of the company have been diminished by the delays and losses due to the recent severe weather.

NEW YORK, NEW HAVEN & HARTFORD.—This company has taken over the Fair Haven & Westville trolley system, which operates in New Haven, with branches to Mt. Carmel, Woodmont, Branford and Derby, a total of about 110 miles. It is stated that the Consolidated is to pay for the stock of the Fair Haven & Westville on a basis of two to one, issuing 3½ per cent., 50-year debentures in exchange. The authorized capital stock of the Fair Haven & Westville is $5,000,000, of which $3,790,400 has been paid in. The funded debt is $1,133,000.

PHILIPPINE RAILROADS.—A bill is shortly to be introduced in the House of Representatives at Washington, authorizing the Philippine Government to execute a guarantee of 4 per cent. interest annually on $40,000,000 of bonds to be issued for the purpose of building a number of railroads in the Philippine Islands. Secretary of War Taft is reported to have made the statement that in certain parts of the islands new railroads will yield a dividend of 4 per cent. from the beginning. The proposed law contemplates a restriction limiting the guarantee to American and Philippine investors.

QUEEN ANNE'S.—Judge Morris, of the U. S. District Court, has appointed Frank Ehlan as receiver of this company. This action is the result of a petition of the Queen Anne's Ferry & Equipment Co., to which the railroad owes $17,061. President Bosley, of the railroad, is quoted as saying: "Our company has a floating debt; but it does not owe anything to financial institutions, and it can pay every cent of the amount which it owes the Queen Anne's Ferry & Equipment Co."

ROARING CREEK & CHARLESTON.—E. J. Berwind, of the Berwind-White Coal Mining Co., has purchased this railroad, which runs between Mabie, W. Va., and Leiter, nine miles. It is stated that the road will be extended 18 miles to coal fields.

SEABOARD AIR LINE.—Blair & Co. announce that under the offer made to the stockholders, 40 per cent. of the new bonds have been taken. Stockholders had the right to subscribe at par to $5,000,000 5 per cent. collateral trust and general lien bonds, receiving with each $1,000 bond a bonus of $900 in preferred and $1,600 in common stock. The proceeds from the sale of these bonds will be used to build the Birmingham extension and to take up the $2,500,000 collateral trust notes due on June 1, 1904.

TEXAS & PACIFIC.—At a meeting of the directors of this company on Feb 8, it was decided to pass the interest on the second mortgage income bonds. Two days later the board reconsidered the matter and voted to pay the regular 5 per cent. interest on the bonds out of net income. Of the total issue of $24,000,650 second mortgage income bonds all except $980,000 are owned by the St. Louis, Iron Mountain & Southern.

RAILROAD GAZETTE

FRIDAY, MARCH 11, 1904.

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## Blocking Up Track in Severe Cold Weather.

With zero and below-zero weather through most of the winter, on a single track with only a few inches of very old cinder ballast, the frost gets down to a depth of 3 or 4 ft. and makes trouble. And it is daily trouble, for, from causes not definitely known, a joint or a rail occasionally heaves as much as 3 in. in a single night. When this happens to both rails alike, it is simply an objectionable matter, not a serious one; but, with one rail up, there enters a danger of spreading rail and a slow order has to be made until the place can be surfaced. The unequal heaving seems to be continuous and somewhat in proportion to the increasing depth of frost in the ground. Without full knowledge of the kinds of material under different parts of the track, the roadmaster is not able to say what kind produces the least inequalities when it expands by freezing; but he is quite sure that clay is the worst, especially where it occurs in pockets.

The sudden settlements are quite as troublesome, and even more dangerous than the lifts. Occasionally an abnormal day with hot sunshine makes soft spots, but the most of the settlements come from heavy unseasonable rains which fill the culverts with running water and draw the frost out of the earth above. With a busy single track to care for the roadmaster finds enough to do to keep it passable. It is not a question of how best to do it with the materials available. When at one spot a rail lifts several inches, the quickest remedy is to hew that much out of the ties, and when delay costs more than ties, this may be done, although it stores up more troubles for the time when the frost comes out. A danger in this is the foreman's temptation to turn the tie over when frost leaves the ground and so secure the normal surface for the rail with the least possible work. This makes a weak spot in the track that cannot be watched and the first indication of weakness is a broken tie.

Most of the work consists of blocking up the rails, and of substituting thicker for thinner blocks as the severe and changeable weather varies the surface week by week, and often day by day. It is soon found that too much of the men's time is used in sawing wood; but a neighboring saw mill can in a few days supply the line with blocks and the foreman's hatchet does the rest.

When rails are blocked up inches, the conditions are ripe for spreading track, and probably no other kind of accident is more distasteful to a roadmaster. A hardwood brace, double spiked to the tie at its outer end, does not look handsome, but it is pretty safe for rail blocked up to 2 in. high. When the job is well done it is not easy to see why it is not fully as safe as a rail braced with old tie plates. Nevertheless, every section foreman asks for the old tie plates, and insists that, used as braces, they are more solid and safe than wood. It takes less time to put them in, and possibly this is the real reason the foremen like them.

The critical time under these conditions, is when the frost suddenly leaves the ground, and the work of several months has to be undone in the shortest possible time. The spots of highest heaving are where the ground is frozen deepest and these are the last places to settle. The adjacent track will settle first and make the highest blocking of the year necessary. Men who have had training enough to be trusted in this sort of work can rarely be hired for a few days, so that money spent on green hands does little good. The schedule is slowed down, and the enginemen and train crews are irritated by slow orders, changing conditions of the road bed and the nervous activities of the conscientious section foreman. Reports of bad spots are telegraphed in freely. It is then that the roadmaster, with such level-headed assistants as he has, needs to be moving all the while, for he cannot always tell from his office whether a report is inspired by an engineman who was not up in time to eat his breakfast before his run started, or that he needed some excuse for not making his time, or that there is really a dangerous place in the track.

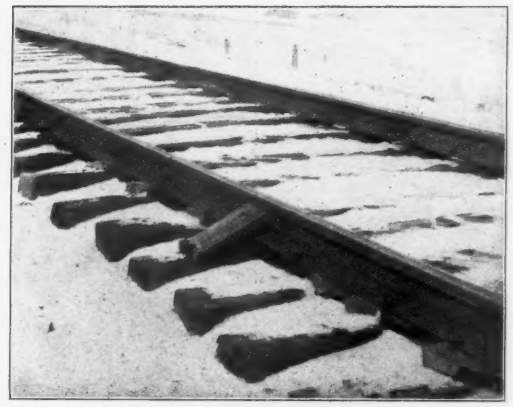
The photographs show hasty, imperfect, work done in an emergency. The following are good rules for blocking up:

Where blocks are put in the track 1 in. or more in thickness they should be about 18 in. long and bored on each end to hold 8-in. spikes.

If blocking must be 2 in. or more in thickness, extend blocks far enough to hold a rail brace on the outside of the rail.

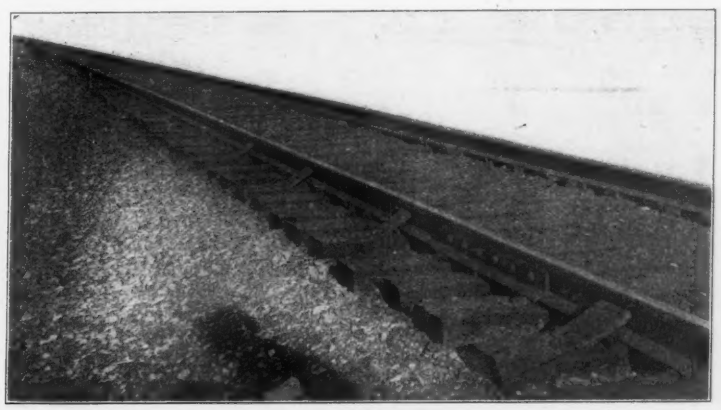
If blocks are 2 in. or more in thickness, they should extend the entire length of the tie and be braced and spiked as above.

Ask for these braces if you need them, and correct your present shimming as soon as possible.



Temporary Protection of Blocked-Up Track.

Running Water Through a Culvert Takes the Frost Out and Track Settles.



Old Tie Plates Are Good Rail Braces for Blocked-Up Track.

## Wrecking Outfits on the Pennsylvania.

Previous articles in the *Railroad Gazette* (Dec. 4, 1903; Jan. 15, 1904) described in some detail the organization and apparatus of the wrecking crews on the New York Central and the Lackawanna. On the Pennsylvania the outfits and methods of handling are somewhat different from either of the other two. The wreck trains are held at all of the important terminals and division points and on the mountain divisions are placed at other points on the line at intervals of about 50 miles. Each train is in charge of a wreckmaster and an assistant foreman who is also the crane engineer. The wreck masters are always within call and on the divisions where the work is the heaviest there is a day and a night wreck master. They are under the General Car Foreman, and report to him, receiving orders from the Motive Power Department. When not in service the trains are held at the car shops on a special siding near the storehouse, steam being kept up under the crane boiler at all times. A commissary man is kept on each train who is responsible, under the foreman's direction, for the condition of the tools and equipment and who draws the necessary tools, blocking and supplies from the store house. When at the scene of a wreck he has charge of supplying tools from the cars and sees that each tool is returned to its proper place before leaving.

The crew of the wreck train is drawn from the force of car-repairers when more than the regular crew of eight or ten men is needed for an emergency. At night an extra force of 30 or 40 men is always kept at work on car repairing in the car shops and these men are instantly available for night work on the road. The repair men are divided into gangs of ten men each and under the direction of the Foreman of Car Shops, are detailed to the wreck train in bodies as required. In case of wrecks accompanied with loss of life or injuries, a special car with surgeons and hospital appliances is made ready and taken out as soon as possible after the call. The duty of the wreckmaster and his men is primarily to clear the track of obstructions and salvage as much of the freight as possible; the repairing of the track and roadbed is left to the nearest section gangs under the direction of an officer of the Maintenance of Way Department, usually an Assistant Division Engineer.

The wreck train and outfit stationed at Altoona, Pa., is a good example of the road's equipment, used for handling wrecks, where they occur perhaps more frequently than on any other part of the line. The train is made up of a 75-ton steam crane, a flat car which serves as a tender to the crane and on which are loaded extra trucks, frogs, rails, heavy wrecking tools, etc.; a tool car for the heavy small tools and blocking, and another similar car behind which is used as a bunk car for the men and in which are carried ropes and tackle, small tools, lanterns and other miscellaneous equipment. This train handles all wrecks in the yards on both sides of Altoona and on the main line in each direction for distances up to about 30 miles beyond Altoona. It is, of course, subject to call for greater distances in case of serious wrecks requiring the aid of two or more cranes and crews. Ordinarily it is kept busy for the greater part of the time clearing up minor wrecks in the yards and for this purpose a Class R mogul engine and crew is used without, however, attaching a cabin car to the train. This engine and crew is also used when taking the train out on the main line on the Middle Division, but when the train is called out for the Pittsburg Division, a regular road engine and train crew of that division is assigned.

The equipment of the train includes the usual tools carried for handling wrecks, substantially as given in the detailed lists in previous articles, but besides these a number of special tools and devices have been designed and are in use on nearly all of the trains on the line. Many of them have been worked up from crude makeshifts used at one time or another, and all of them are extremely valuable. When the steel car was first introduced the tools used in clearing wooden cars from the track were often cumbersome and even dangerous when applied to a wrecked steel car. Special appliances have been made and are now in use by which this class of cars are handled even more quickly and with less damage than the wooden cars. The accompanying drawing on the next page shows the details of a few of the most interesting devices.

Fig. 1 is a shackle for lifting cars with drop doors by attaching it around the center sills. The U-forging is 10

in. deep and 20 in. wide, made of 2¼-in. square iron. The chain links are 1-in. round iron. It is readily applied and removed by means of the hook on the eye-link which hooks into the adjoining link of the side chain. Fig. 2 is one of the most useful tools carried on the train. It is one of a pair of stone hooks with sharp points and, when attached to a suitable rope or chain sling, can be used for lifting or dragging almost any kind of bulky obstruction, large stones, castings and other freight which may be sideways by bearing against the guard arm. The pull is taken in a direct line with the center line of draft and results in small damage to the car or draft gear. Fig. 5 is a clevis intended to be placed around the shank of the coupler for lifting the end of the car. The pin, shown in Fig. 6, is elliptical, with the large diameter, 2¾ in., vertical. Fig. 7 is a special double hook, shaped to fit the ends of the bolsters on metal cars. One of these is placed under the bolster on each side and wire cable slings are the crane hook and the car is evenly balanced. One sling may be used for lifting one end of the car only or both hooks on the same sling can be hooked under the sill on one side and the car rolled over. The detail shown in Fig. 9 has a somewhat similar use, being intended to hook into the roping staples on the end of the car for lifting. Wire cable, 1 in. in diameter, is used instead of the 2-in. rope.

Fig. 10 is a flat hook designed for handling steel cars

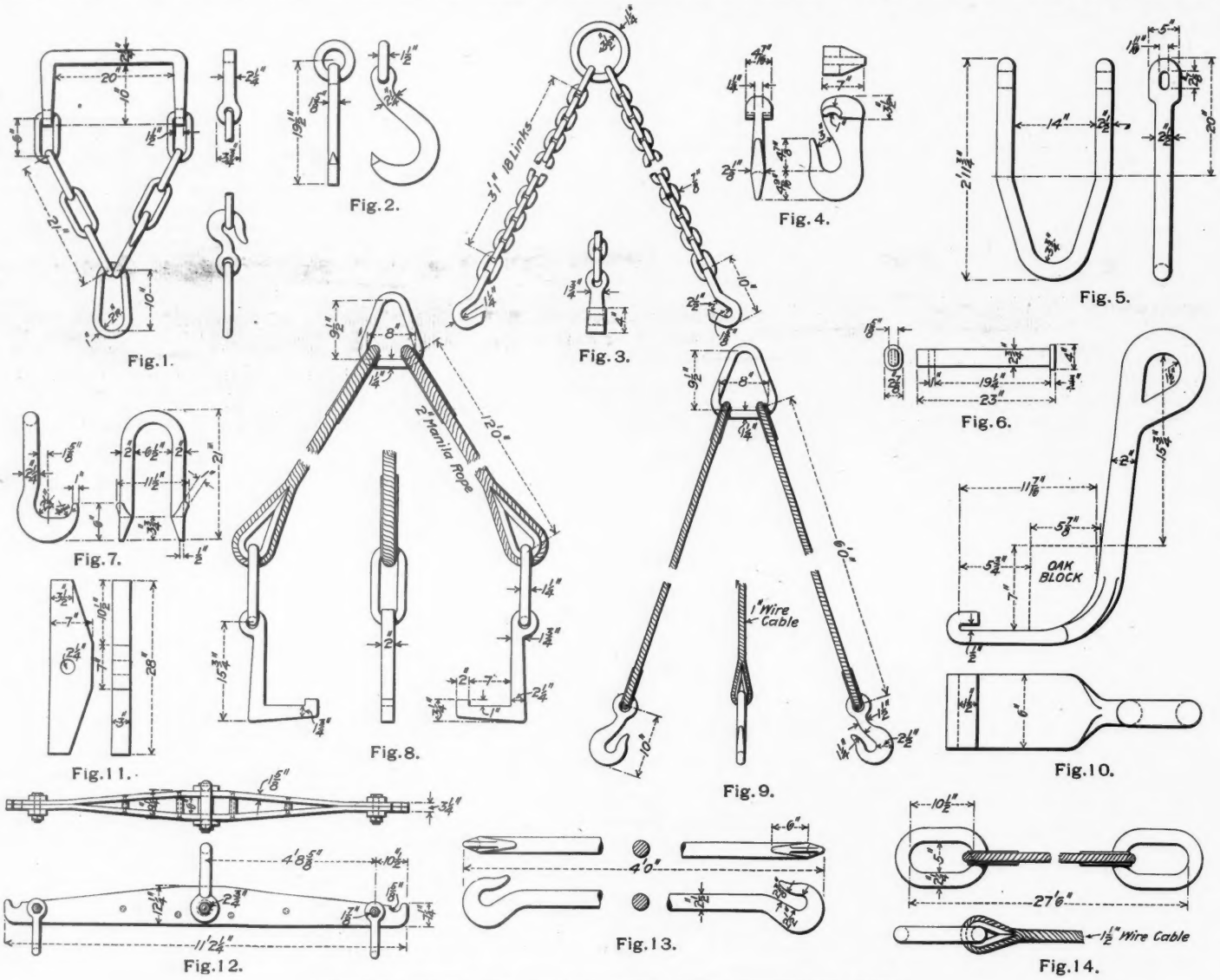
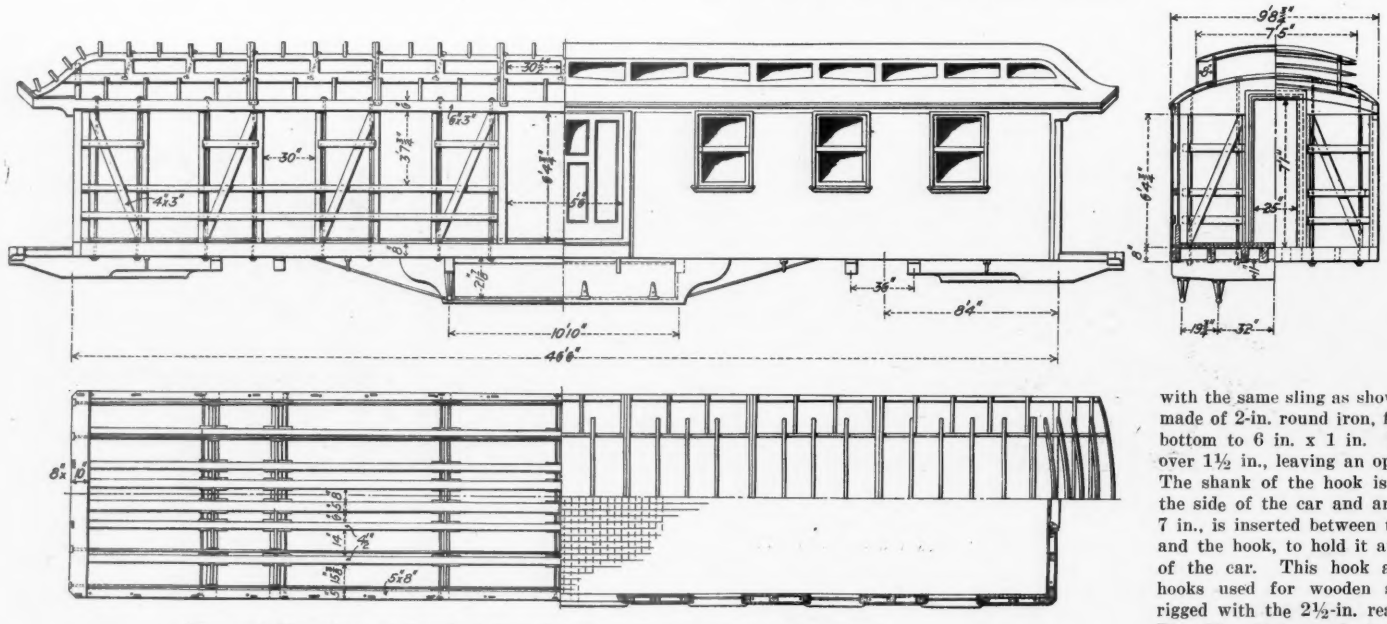



Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5. Fig. 6. Fig. 7. Fig. 8. Fig. 9. Fig. 10. Fig. 11. Fig. 12. Fig. 13. Fig. 14.

Details of Special Tools Carried on Wreck Trains—Pennsylvania Railroad.



Plan and Elevations of Standard Tool Car, Class T B, Pennsylvania Railroad.

lying on the track. Fig. 3 is a special double chain sling for handling arch-bar trucks. The flat hooks on the ends of the chains are 3 in. wide and 1¼ in. thick and have an opening 2½ in. wide at the mouth, 1⅝ in. wide at the bottom and 3 in. deep. They can be hooked over the arch bars of a truck and hold it securely while it is being moved.

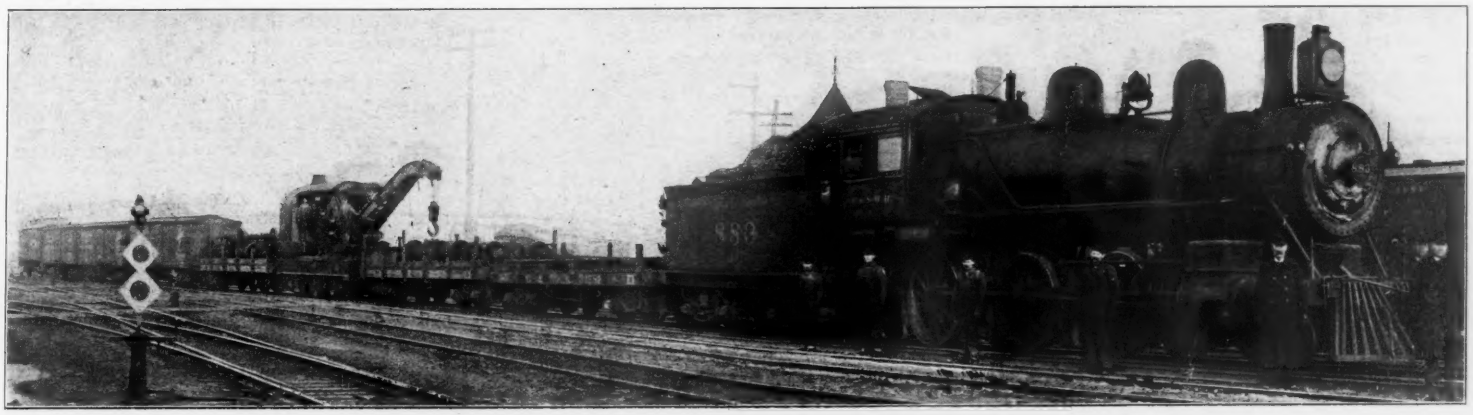
Fig. 4 is a patented hook, designed by Mr. David Goodman, wreckmaster at Altoona, for pulling on M. C. B. couplers. The hook is inserted in the slot of the knuckle and the shoulder formed on one end bears against the inside face of the knuckle. The back end of the hook conforms roughly to the contour line of the coupler and prevents the hook from slipping out of the knuckle slot hooked into them and over the ends of the hoist beam attached to the crane hook.

Fig. 8 is a rope sling with hooks attached which is used for lifting or rolling over box cars with wooden sills. Two pairs are carried and with the hoist beam the whole car can be lifted and evenly balanced. The 2-in. manila rope slings are 12 ft. long and are spliced with rope thimbles into a triangular link at the top. At the bottom end of each rope is a loose link and L-hook made of 2¼-in. x 2-in. iron with a lip forged on the end, 1 in. high, giving an opening of 7 in. If the car is to be lifted entirely off the ground one of these slings is passed around the body over each needle beam and the hooks placed under the side sills. Both of the triangular links are hooked into with the same sling as shown in Fig. 8. It is made of 2-in. round iron, flattened out at the bottom to 6 in. x 1 in. The end is turned over 1½ in., leaving an opening ½ in. wide. The shank of the hook is bent out to clear the side of the car and an oak block, 5⅞ x 7 in., is inserted between the web of the sill and the hook, to hold it away from the side of the car. This hook as well as the L-hooks used for wooden sills, can also be rigged with the 2½-in. reach rods shown in Fig. 13, which couple into the clevises on the ends of the hoist beam. Fig. 11 is a flat bar forging, 28 in. long, 7 in. and 3½ in. wide and 3 in. thick, with a 2¼-in. hole in the center, and is used in pulling on the back end of locomotives. Some time ago in pulling on an engine which hung over an embankment, a sound 8-in. x 10-in. oak tie, which was placed in the fire-box across the fire-door, was cut completely in two and the engine plunged down to the bottom of the bank. The forging shown was then made a part of the outfit to prevent another such accident. It is easily handled and is amply strong.

The hoist beam for the crane hook is shown in Fig. 12. It is made of two plates, 1⅝ in. thick and 12¼ in. wide at the center, tapering to 7¼ in. at the ends, and separated with four filling blocks riveted in between. It is

hung from the crane hook with a heavy clevis and 2¾-in. pin, and 10½-in. from each end a lighter clevis is attached into which the hoisting slings can be hooked. A semi-circular notch 1⅝ in. in diameter is cut on the top edge at each end to hold the reach rods shown in Fig. 13. The beam is 11 ft. 2¼ in. long, greater than the width of any car body, so that the slings or reach rods do not crush in the bodies at the eaves when used for lifting.

Fig. 14 shows one of a number of wire cables of different lengths with links at each end. The one shown is 27 ft. 6 in. long and is intended to pass around the boiler of a locomotive for lifting it. Many of these devices are used in combination with each other for special work. Each piece is made to be readily hooked into links or rings on the others and almost any work of lifting or dragging cars or locomotives can be accomplished easily and quickly with the aid of suitable blocking, jacks and rope and tackle.



Wrecking Outfit at Clinton, Iowa—Chicago & North Western.

The crane used at Altoona, a number of which of similar design have recently been put in service at other points, is rated at 75 tons lifting capacity, with the main hook at a 16-ft. radius. Its actual capacity by test is 100 tons at that radius. It weighs 112 tons and is the most powerful type of crane in use. An auxiliary hook without sheave for rapid hoisting is provided on the end of the boom to which is attached 150 ft. of cable. A Wells light is mounted on the boom and air is supplied to the oil tank by an 8-in. Westinghouse air pump mounted on the side of the boiler house. The crane was designed and built by the Industrial Works, Bay City, Mich.

The flat car coupled next to the crane carries two complete 80,000-lb. trucks and one 100,000-lb. truck and many of the heavier crane tools, track connections and rails, long timbers and heavy blocking. It is heavily reinforced with subsoils and extra truss rods and underneath it is carried a large tool box, containing miscellaneous tools. The two tool cars usually made up in a wreck train are built to the plans shown in the accompanying engraving. They are 46 ft. 6 in. long over bodies and have side and end doors and open platforms. The framing and general construction is similar to that used in standard passenger equipment and the cars are mounted on 4-wheel passenger trucks. A tool box, 10 ft. 10 in. long and 21⅞ in. deep, is built under the center of the cars clear across. The interior arrangement of bins and bulkheads is left to the wreckmaster who will have charge of the car when in service and is varied to suit. In the train at Altoona the first car next to the flat car is divided up at one end into open bins and tiers of shelves in which the hydraulic jacks, track tools, sledges, pinch bars, shovels, wrenches and similar tools are kept. In the center of the car are the bins for blocking and wedges and also for the oil tanks. A small space at the other end contains a galley stove and low bins on either side which are covered with cushions.

The second tool car is divided in the middle with a bulkhead and at one end a row of low bins for small tools is built along both sides with a wide aisle down the center. This part of the car is used by the men when going to or from a wreck and forms a comfortable compartment for their use. The wreckmaster and timekeeper have a small desk against the bulkhead. The other end of the car contains broad, deep bins for storing rope, cables and chain, and at the extreme end is a small stove and cupboards for the commissary supplies. These bins are all covered with cushions and can be utilized for sleeping quarters for the men or as a temporary hospital.

On such a busy line as the Pennsylvania the clearing of the tracks is the first consideration, but one of the important duties of the wrecking crew is the preserving of partly damaged and wholly uninjured freight and reducing as much as possible the claims made against the road.

Tender and Hospital Car.

The wreck train carries 25 suits of white duck for the men to put on while handling dressed meat and also a large number of grain sacks and tarpaulins for gathering up and protecting grain shipments and merchandise. One of the most frequent accidents which happen in the yards is the dropping of the doors on a hopper car loaded with coal and coke, followed by the derailment of the car when the load dumps on the track. After the car has been replaced on the track the coal must be reloaded if the car is not badly damaged or loaded into an empty for re-shipment. To do this quickly and easily a 2½-yard drag shovel or bucket has recently been built at the company's shops and is carried on the flat car of the wrecking train. The coal can be easily shoveled into the bucket standing on the ground and hoisted with the crane over the car to be loaded and the bottom dropped with a tripping device, or if the contents of a number of cars is spread out over a large area, as is often the case in wrecks on the road, the shovel can be dragged along the ground and used to scrape the coal up into a heap from which it can be reloaded. This addition to the equipment has proved very useful.

We are indebted to W. W. Atterbury, General Manager, and to A. W. Gibbs, General Superintendent of Motive Power, for the information and drawings.

### The North Western Wrecking Outfits.

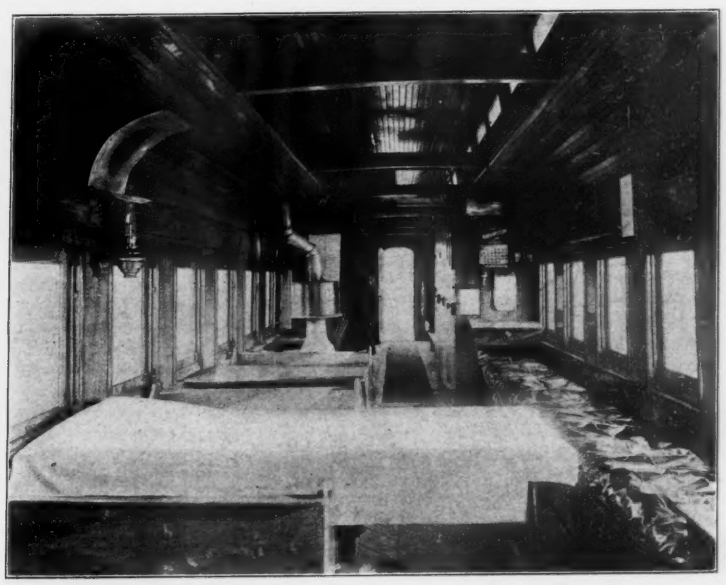
The Chicago & North Western has steam wrecking outfits located at all of its principal terminals, the outfits consisting of a 50-ton steam derrick, two tool cars, a blocking car, two flat cars carrying assorted trucks, one flat car carrying rails, switches, etc., one tender and hospital car. The crew includes a wrecking master, crane engineman, cranesman and five car repairmen, one of which acts as cook and steward. These men are regularly employed about the shops or repair yards adjacent to the location of the wrecking outfit. The latter stands on a special track and the derrick car is housed. No steam connection is made to this car in the house, as experience has shown that the required steam is available before, or by the time, the train has reached the wreck. The train is equipped throughout with air. A regularly assigned train crew remains in the caboose day and night and the first available locomotive is used.

When a call is made for the wreck train in the day time a prearranged whistle signal at the shops immediately assembles the men. At night they are summoned by telephone or caller. The caller also notifies the conductor at the wrecker, who immediately reports to the Trainmaster by telephone. The latter gives him all necessary information as to the location and extent of the wreck and what is wanted, including the men and material he will need to take with him.

If there is a locomotive in the wreck the Master Mechanic sends machinists, and accompanies the train himself if the wreck is serious. The Assistant Superintendent or the Trainmaster always accompanies the train, and the Roadmaster also when practicable. During the preparations for the start the necessary section forces are being assembled, to be picked up by the wreck train if possible, or by the first regular train available. The average time required for starting in the day time is 20 minutes, and at night 30 minutes.

The photographs are from the outfit located at Clinton, Iowa, 138 miles west of Chicago, which serves the eastern half of the Iowa division and the western half of the Galena division. The tender and hospital car serves the purpose of a hospital, sleeping and dining car. There are ten berths for the use of the men going to and from wrecks, or for injured persons when necessary. When used as a dining car the tables will accommodate

Arrangements for Feeding Men in Tender.



Operating Table and Arrangements for Treating Injured Persons.

eight persons. Its equipment includes a kitchen range, a heater for hot water, a stock of provisions, a full line of bedding, and a quite complete list of hospital and medical supplies, with operating table, stretcher, etc., and complete instructions for their use and application prior to the arrival of a surgeon. These instructions are placed on the door of the surgeon's supply press, together with a list of its contents, which is as follows:

1 bottle alcohol.
1 bottle antiseptic powder.
Operating apron and rubber apron.
Assorted bandages.
2 porcelain basins.
1 bottle Bernay's bichloride of mercury tablets.
2 woolen blankets.
2 hot water bottles.
2 hand brushes.
2 oz. carbolic acid.
1 catheter.
2 lbs. cotton.
1 dipper.
1 Esmarch bandage.
1 lb. ether.
Gauze:
5 yds. iodoform.
5 yds. sterilized.
5 yds. sublimated.
Ligature:
Catgut, sizes 1, 2, 3, 4.
Kangaroo, assorted sizes.
1 litter.
1 box malted milk.
1 tube morphine (hypodermic 1¼ gr.).
1 pitcher.
1 box safety pins.
6 boxes 2-in. plaster of paris bandages.
6 boxes 3-in. plaster of paris bandages.
1 3-in. adhesive plaster.
1 bottle salt solution normal (tablets).
2 linen sheets.
1 rubber sheet.
1 can green soap.
Assorted splints.
1 sterilizer.
1 tube strychnia (hypodermic).
1 fountain syringe.
1 hypodermic syringe.
1 bottle horse-hair sutures.
1 straw silk-worm gut sutures.
1 tank (cold sterilized water).
1 tourniquet bandage.
6 towels.
3 instrument trays.
4 oz. turpentine.
1 transfusion needle.

The equipment carried on the Clinton wrecker is as follows:

1 set 90-lb. cross-overs (complete).
1 set 80-lb. cross-overs (complete).
200 ft. 90-lb. rail.
200 ft. 80-lb. rail.
6 car trucks.
1 locomotive truck.
1 tank truck.
2 middle outrakers for steam derrick.
1 equalizer for raising coaches.
Assorted blocking.
2 pair Alexander replacers.
2 pair Tilden replacers.
2 paid Fewing frogs.
80 ties.
3 kegs spikes.
3 kegs ⅞-in. track bolts.
3 kegs ¾-in. track bolts.
1,000 nut locks.
6 spike mauls.
6 track shovels.
6 scoop shovels.
4 claw bars.
2 track gages.
6 picks.
4 ¾-in. track wrenches.
4 ⅞-in. track wrenches.
2 sets switch rods.
4 switchstands and lights.
1 telegraph cabin.
1 box relay.
1 coil of wire.
Pliers, climbers and screw driver.
1 claw hammer.
1 hand axe.
62 sacks.
7 galvanized-iron bushel baskets.
1 headlight.
2 hydraulic jacks.
2 screw jacks.
4 Barrett jacks.
2 20 ft. x 40 ft. tarpaulins.
4 3-in. switch ropes.
2 4-in. switch ropes.
400 ft. of 3-in. Manila rope, with tackling blocks to fit.
200 ft. of 2-in. rope, with tackling blocks to fit.
1 3-in. snatch block.
1 1½-in. x 20-ft. chain.
1 1½-in. x 30-ft. chain.
2 chopping axes.
1 cross-cut saw.
2 chisels.
2 sledges.
2 15-in. monkey wrenches
Car repairers' hammers.
2 pails dope.
2 cans oil.
2 pair car hooks.
2 pair truck hooks.
2 wire cables.
2 iron-bound planks, 12 ft. long.
2 iron-bound planks, 4 ft. long.
2 iron-bound planks, 6 ft. long
12 various-sized clevises.
6 various-sized hooks.

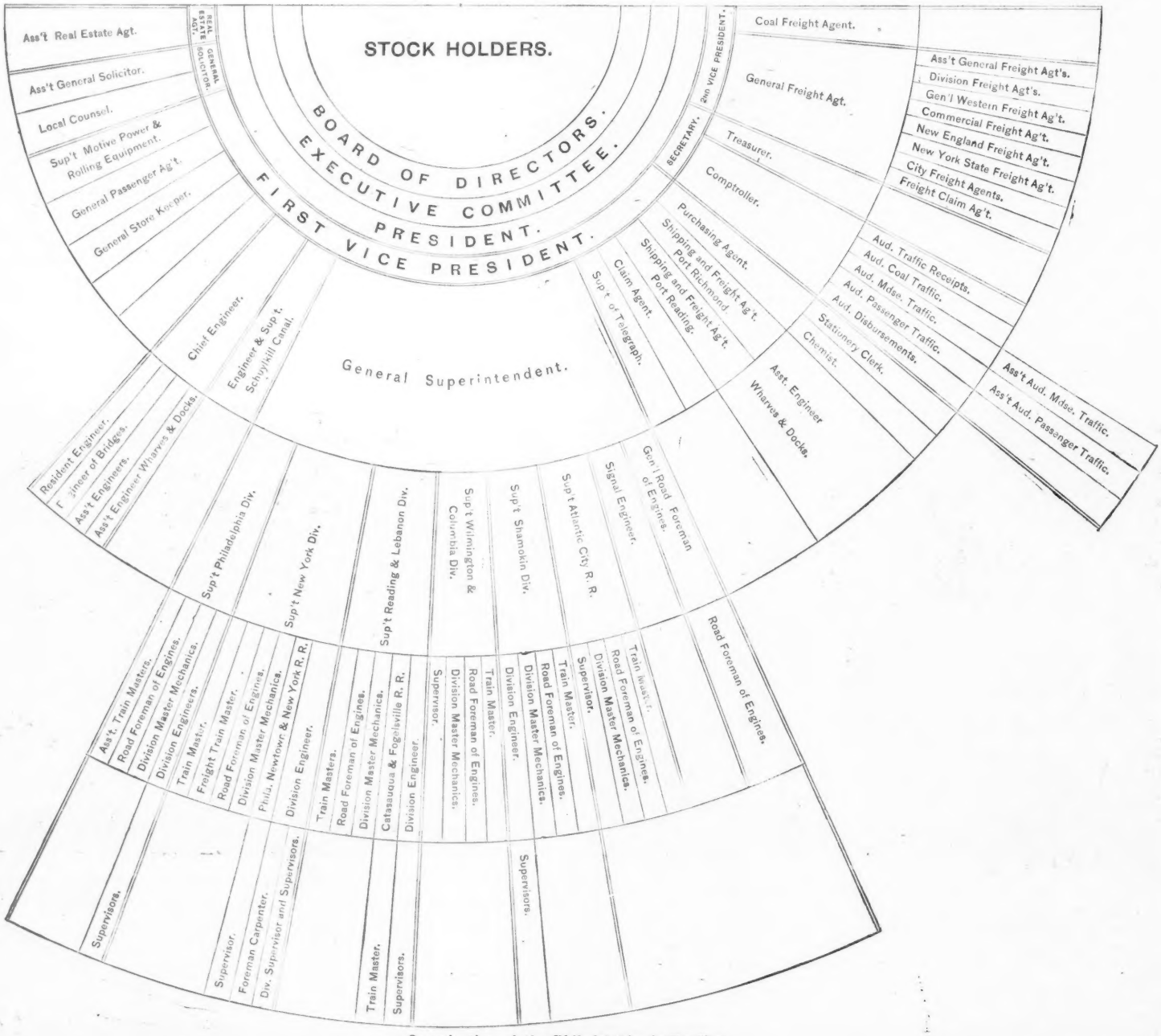
The commissary car is equipped with:

Bunks sufficient to hold 10 men (2 men can also sleep on the lockers), mattresses, blankets, etc.
2 dining tables.
Stretcher.
Operating table.
Supply of surgical instruments, bandages, medicine, etc.
1 Babcock fire extinguisher.
6 car repairers' Dietz lanterns.
1 pair tail lights, flags, and all necessary equipment that goes with way-car for train crews.

We are indebted to Mr. R. H. Aishton, Assistant General Manager, for the photographs and other data.

## Organization of the Philadelphia & Reading.

The strong divisional organization of the Philadelphia & Reading, as shown in the accompanying diagram, presents several quite unusual features. There is no title of general manager, but the first vice-president covers his duties, together with some others that would ordinarily fall to a different official. The purchasing agent, claim agent, general storekeeper and general passenger agent all report to him directly. The general superintendent, besides jurisdiction over his six division superintendents, receives reports from the general road foreman of engines and from the signal engineer, which each division superintendent has a division engineer, division master mechanic and road foreman of engines. It is interesting to note




Organization of the Philadelphia & Reading.

that while the general passenger agent, with his department, reports to the first vice-president, the general freight agent reports to the second vice-president, who is under the direct authority of the president. This was brought about by reason of the fact that the second vice-president of the Philadelphia & Reading Railroad is also first vice-president of the Philadelphia & Reading Coal & Iron Company, and as such has entire jurisdiction over all matters pertaining to the selling and handling of the Reading Company's coal business, constituting, of course, an extremely important part of the entire freight. It will be seen also that the secretary has extended powers, and under some organizations would doubtless be called a vice-president. His position as head of the auditing department (he also has jurisdiction over the treasurer) makes his field in certain ways similar to that of the fourth vice-president of the New York Central. The general solicitor and the real estate agent report direct to the president. The arrangement of the Philadelphia & Reading diagram, which is reproduced from a drawing kindly sent by the First Vice-President, is particularly clear.

### Organization of the Chicago Great Western.

The operating organization, a diagram of which is printed below, went into effect on the Chicago Great Western Jan. 5, 1904. It will be seen that it is clearly divisional in character, the car service agent and superintendent of motive power, as well as the terminal and division superintendents, reporting to the general superintendent, and through him to the general manager. The division engineers, signalmen, and drawbridge engineers and division master mechanics report direct to their division superintendent. The assistant general manager has specific duties rather limited in character, the responsibility for operation going direct through the general superintendent to the general manager. Superintendents and division engineers naturally report to the chief engineer as to standards and methods, and the signal engineer is also made a staff officer, reporting direct to the general manager.

OPERATING ORGANIZATION OF THE CHICAGO GREAT WESTERN.

- **General Manager.**
  - **Assistant General Manager.**
    - Purchasing Agent.
      - Tie Inspectors.
      - Fuel Inspectors.
    - Superintendent Dining Cars.
    - General Storekeeper.
      - Storekeepers.
    - General Advertising Agent.
  - **General Traffic Manager.**
    - General Freight Agent.
      - Commercial Agents.
      - Division Freight Agents.
      - Agents off Line.
      - General Agent St. Paul.
        - City Passenger Agent.
    - General Passenger Agent.
      - City Passenger Agents, except at Minneapolis, St. Paul, Omaha and Kansas City, where they report to General Agents.
      - Division Passenger Agents.
      - Agents off Line.
    - Grain Agent.
      - Elevator Employees at St. Joseph and Kansas City.
  - **General Superintendent**
    - Car Service Agent.
    - Weighing Inspector.
    - Superintendent Motive Power.
      - Master Mechanic, Oelwein.
        - Roundhouse Foremen.
        - Shop Foremen.
        - Car Foremen.
        - Coal Chute Foremen.
      - Boiler Inspector.
      - Air-Brake Instructor.
      - Superintendents and Division Master Mechanics as to standards and methods.
      - General Car Foreman.
        - Car Foremen as to standards and methods.
    - Superintendent Oelwein Terminals.
      - Agent.
      - Yardmaster.
      - Signalmen.
      - Section Foreman
    - Superintendents.
      - Agents.
      - Trainmasters.
      - Chief Despatchers.
      - Linemen.
      - Signalmen and Draw Bridge Engineers.
      - Division Master Mechanics.
        - Roundhouse Foremen.
        - Coal Chute Foremen.
        - Traveling Engineers.
      - Division Car Foremen.
      - Division Engineers.
        - Roadmasters.
        - Bridge Supervisors.
  - **Chief Engineer.**
    - Bridge Engineer.
    - Engineers Special Work.
    - Superintendents and Division Engineers as to standards and methods.
  - **Signal Engineer.**
    - Signal Foremen and Repairmen.
    - Signalmen as to care of signals and plants.

### Some Thoughts and Suggestions on Railroad Organization and Management.

BY A. M. WAITT.

The rapid growth and development of our American railroads, and especially the growing necessity and tendency for combining under one general management lines controlled by the same financial interests, have made necessary quite a radical change in the systems of organization which have been found in the past sufficient and satisfactory for successfully conducting the business of our small railroads.

The merging of kindred interests and the growth by purchase, leasing or otherwise of single roads to large systems involving many thousands of miles of track, and large numbers of locomotives, cars and employees, have outrun the most advanced plans which have heretofore been made for the satisfactory conduct of the multitudinous details of system railroad management, and it is an undoubted fact that on not a few of the large systems there now exists a state of chaos and undetermined policy concerning what is the best plan of organization to be followed.

For many years past, with the slower growth of individual lines and the occasional absorption of a few small connecting roads, it has seemed possible to extend the system of organization in vogue on the principal line to those absorbed, and the general officers have gradually had placed upon them added duties and jurisdiction, until in far too many cases the roads are suffering from the absolute impossibility of those in the more responsible positions in the management being able to handle the work imposed upon them in the manner they had been in the habit of doing with a less extensive field to cover. In the greatly increased territory supervised, it is rarely possible for the general supervising officers to keep in touch with the details of a large system, as was perfectly possible with a single road.

In some cases presidents, vice-presidents and general managers have endeavored to still carry the old burden of details, with one of three results. Either the system has developed in a one-sided way (the line in which the officer was originally trained) or the road has not developed satisfactorily, and is still lacking in system; or unfortunately the head of the system has paid the penalty of overwork with his life or brokendown health. The history of our American railroads has given many illustrations of this statement, and it is to be feared that more are to follow.

The conducting of large system interests on a successful basis requires at the head a man of special ability to organize, rather than one versed in the detail of department work. Such a man is in many ways benefitted if reinforced by technical knowledge of the profession of railroading in some one or more of its various departments. Good judgment and fairness, coupled with the education furnished by a broad field of observation, are characteristics essential to successful management.

The question arises as to the wisdom of permitting one man, the president, to be burdened with the many complex questions of the detail of finance, construction, maintenance, operation, legal affairs, traffic arrangements and accounting. There may be a few great men who for a time can stand the burden of these many-sided duties, but may not greater and better results be obtained by a reasonable subdivision of the labor?

Inquiry made in England as to some of the features of the organization of railroads there seems to suggest some thoughts for consideration. It is noticeable that on the large English railroad lines, the board of directors is a much larger body than on our American roads. There seems to be no office of president, but there is a chairman (usually an honorary position) and a vice-chairman, who is the active presiding officer at the meetings of the board. The chief executive officer is the general manager, whose duties so far as the supervising and harmonizing the work of the various departments, corresponds quite closely to the duties of many of our American presidents and vice-presidents, with the expection that on American roads the president is the final arbiter of nearly all questions, his action being almost universally approved by the directors.

The board of directors on the English roads are subdivided into various committees, three or more being selected to give special attention to the needs and work of an individual department. All matters pertaining to the appropriation of money for the needs of that department are presented by the head of that department to the department committee at a regular bi-monthly meeting, at which the committee, the head of the department, and sometimes but not frequently the general manager, are present. All large appropriations for the needs of the department are thus considered by the committee of directors, the need being presented by the head of the special department who best knows the requirements and can best set them forth and can best answer inquiries as to such matters. The small committee, as a rule, then and there decides as to the appropriations, and such decisions are formally endorsed by the full board at their regular monthly meeting, if the appropriation is for a large amount. By this method the board assumes the handling of the appropriations, except for ordinary running expenses, which require no special action, and every month at a stated day is in contact with the immediate needs of every department, so that the frequent excessive delays and loss of opportunity, as well as time, which so many department heads on American railroads have experienced, are avoided, and the directors have a closer touch on the expenditures than is now customary in America—at least on many roads.

The key to success in the organization of a large railroad system would seem to be in selecting for the active head of each department the very best man obtainable in that special line. Especial attention should be given not only to the man's ability from a technical standpoint, but to his ability as an organizer in his particular department, and his judgment in selecting and dealing with men. The most successful man for the head of a department is not the man who can put in the most hours at a desk and who can work hard himself, but rather the one who has the faculty of keeping others at work to good purpose, and knows how to so keep in touch with his subordinates as to know what they are doing and to direct their general movements. It is not the general on the field of battle who wields his sword or shoots the most who is the greatest commander, but the one who from some vantage point can overlook the field of battle, note the movements of his regiments, and direct the dispatching of reinforcements to weakened points and plan strategic moves which will confuse and vanquish the enemy, at the same time standing ready in case of extreme urgency to unsheath his sword and go into the thickest of the fight to lead his men to victory.

In railroad organization for large systems more of the military type of organization is needed, both in the way of a general staff for assisting the chief executive officer and also a corresponding department staff for the assistance of the department chief. It may be laid down as a safe general principle that both the chief executive officer of a large system and the department chiefs on such a system should be free and unfettered by routine and detail work, for which competent assistants can be procured, and to whom such work can be delegated. Great advance moves are almost universally the product of deep and careful thought, based on observation and experience. The railroad company which allows its chief and highest salaried officers to be so harrassed and occupied with minor detail and routine work that they have not much of their time for observation and thought is failing in most cases to obtain the highest type of service of which such general officers are capable.

One of the very able of chief executive officers of a great American railroad said, while doing his best work: "I never attempt to do the work that I can hire others to do for me. When problems arise that my subordinates cannot solve then I am always ready to have the case referred to me." This gentleman was wonderful for his broad field of knowledge, in his clever disposal of difficult questions, and in his exceptionally clear view and knowledge of the work being accomplished by his subordinates. He was famous in developing a high type of railroad officers, who were independent thinkers and each among the most efficient in their respective lines of work.

A chief who does not allow his aids to think and act for themselves, holding them responsible for the results obtained, dwarfs them and hinders progress, and builds up an organization which will not stand firmly alone, when by death or other cause his support is withdrawn. The greatest executive, either national, financial or mercantile, is the one whose policy is to establish principles and develop an organization which is so self-supporting and which has in it such strong self-contained men that though the chief is absent or retires his work and methods still live, and the institution that he has established continues as strong and impregnable as if he were still at the helm.

In the financial world large and influential corporations aim to so establish themselves that the continued success and stability of principles and methods will not be interfered with by death or continued absence of even the highest officers of the corporation. Similarly should the foundations be laid for our large railroad systems. This means, first, the establishing of a clearly defined and fixed general policy by the directors concerning the aims and future development and improvement of the system. Second, the selection of the best man obtainable to supervise the development of the system. Third, the determining of the best type of organization for producing the results desired. Fourth, the selection of the best men who can be obtained for department heads and subject to the general policy determined upon by the directors and chief executive, to give the department chiefs freedom, each in his own line, to develop the strongest organization and to produce the best results possible.

It may be said that it is not safe to give such freedom

of action; that the men selected may not be safely trusted with so much authority. The answer would be to get only the best, well-tried men obtainable, and then pay them as much as their type of services will command in any market outside of the railroad service. In this way the men selected will be anxious to do their best and to become fixtures with the company, instead of constantly hoping an opportunity will present itself in some other place to get a salary more commensurate with the services required and given. The knowledge of a man's past accomplishments should be a reasonable assurance of his future possibilities.

On this basis build an organization which will be noted for permanency of office and which will make a point of taking in young men of promising character and ability and of educating and developing them in their line of work so that after a period of five, ten or more years the necessity of looking outside for strong men to fill advanced positions will be obviated, by having at home well-trained and efficient men, thoroughly imbued with the fundamental principles on which the progress of the company was founded years before. In this way stability can be assured, strong railroad men educated and the highest type of results obtained. In this country, happily, there can be seen at least one or more examples of the results of over two decades of organized development on these lines, which speaks for itself.

In the past there has been a tendency on the part of railroad companies to so restrict the salaries paid chief officers in many departments as to make them unable to obtain and retain the high class of ability needed in many of their most important lines of service. It is an undoubted fact that the railroads have been losing to outside manufacturing and engineering companies many of their strongest men, due to there being insufficient inducement, either in salaries paid or in prospects for future advancement, to warrant them in entering or remaining in the railroad service. There is perhaps no industry or profession that calls for higher skill and talent in the engineering or mechanical lines than our great railroad systems. To prepare for positions of high responsibility in these lines at the present time requires not only years of study on technical lines, but a practical experience and education that can only be obtained by many years of exacting work at a small remuneration. In Europe these facts are recognized and the heads of these two important departments of railroading have a recognition that is rarely accorded in America, but which goes a long way toward making the positions sought for by a high type of men.

One very noticeable and questionable policy prevails on the railroads in the United States which is seemingly not considered wise or feasible in European railroad practice. It is the tendency of officials who are not versed either in theory or practice along the two engineering lines of the service to interfere and interpose their ideas in preference to the knowledge born of study and long experience, of those who have given their lives to the pursuit of their particular line of work. In England a general manager or a board of directors would look to the chief mechanical engineer for advice as to the class of equipment which ought to be purchased and would not think of setting up his own preconceived notions as superior to the knowledge and skill of an officer whom his company had employed to give his time to the especial study of such matters; neither would he pretend to say how he should operate his department as to its men, methods or standards.

In America such interference is too frequently attempted, to the discouragement of the department chief, and to the demoralization of the department organization and progress. It is, on the face of it, absurd to think that a chief executive officer or a board of directors can wisely assume to know more about technical department details than those who have made such matters a life study. If such an occurrence happens it is evidence either that there is an incapable man at the head of the department, or that those in superior authority are taking the best means possible to disrupt organized work and good discipline. A happy medium would be for chief executive officers not to arbitrarily decide on department questions, but to outline the general policy desired to be pursued and the results wished for and then leave the experts in the respective lines to indicate what is needed to fill the requirements; the responsibility being fully placed on them as well as the authority to go ahead. If the head of the department is not to be trusted with so much authority a new man should be selected who is competent and worthy of trust in full. Expert heads of departments should be allowed full freedom in their own departments, both as to methods, men, organization and the qaulities of materials and devices used.

Unfortunate results are often forced on a department by the unwise practice of directors or officers who are quite ignorant of the possible effects of their requests forcing the adoption of methods, materials, or the employment of men in places where expert knowledge would show that bad results were sure to follow. This is wrong in principle and in the end is bound to produce bad results. When such bad results do follow the ones really responsible are very loath to accept the blame, but the operating officer who carries out their ideas is in most cases loaded with the criticism which properly belongs higher up.

One serious lack on the railroad systems of the country is the almost total want of a definition of duties and responsibilities of the various departments and of the different officers operating in such departments. We find not infrequently "books of rules" for some of the departments in a few of which rules are incorporated carefully outlining the duties and jurisdictions of minor officers in such departments. On most roads there is a lamentable indefiniteness as to the extent of the jurisdiction of the various departments and as to the range of jurisdiction of the various vice-presidents, general managers, general superintendents, chief engineers, superintendents of motive power, purchasing agents, etc., resulting in some cases in certain officers assuming to claim jurisdiction over everything in sight, with much resultant friction, unpleasant feeling, interference, delay and general disorganizing results.

On some roads a purchasing agent in the absence of specific definition of duties to the contrary, will assume that he is competent and is authorized to decide as to the quality and kind of material to be used by the various departments, instead of simply being delegated to purchase the supplies called for on requisitions on the best possible terms, and keeping in touch with the heads of departments, advising them of possible ways of saving money in the purchase of supplies for their use; he thereby puts himself at loggerheads with and as superior to the ones at the head of the special departments, who are being paid to study and to know about such matters. Hundreds of illustrations of this kind will present themselves to railroad officers, and there are many cases where the purchasing agent's saving (?) had to be expended many times over, to repair the bad results consequent upon his unwise assumption of superior technical and practical knowledge.

The history of some of the largest and most successful manufacturing concerns shows the beneficial results attained by the selection and appointment of a competent, high-salaried chief operating officer who has been given complete control of the affairs of the company; the president and the directors keeping their hands off, and allowing the manager full and free authority and jurisdiction, subject to their control only so far as financial matters involving great outlay were concerned. It must not be considered that everything depends upon the man in charge of the operations, for unless such a man is supported and backed financially it may be impossible for him to lift a company out of the ruts of old practices and lack of progress and place it on the hard road bed of success and advancement. A mistake too often made is to withhold financial aid until too late. Many a railroad company has suffered and is suffering to-day from withholding a liberal expenditure of money for modern facilities to provide up-to-date methods and adequate provisions for rapid-growing business, because it could not bring itself to make the needed appropriations until after much lost time, when a period of business depression had arrived and lessened earnings had put a seal on continued lack of proper facilities to conduct the work in an economical manner for perhaps many years to come.

A very interesting feature in English railroad practice, which could be imitated with advantage in this country, is the custom of holding monthly meetings of the heads of all departments with the general manager. These meetings are not a matter of convenience simply, but they are regularly scheduled gatherings which are considered as fixed and as important as the regular meetings of the board of directors, and they serve to put each department in actual touch monthly with every other department and enable matters of importance to be talked over and understood by every department chief.

Much might be said and written as to the two distinctive plans of general organization for railroads, examples of which, together with modifications of each, are readily seen and studied. The "departmental" plan and the "divisional" plan each has its advocates. As railroad systems are assuming such large proportions now there seems to be a leaning toward the departmental plan as being more conducive to rapid results in developing a good strong system organization from a heterogeneous one, which was the result of merging of several differently organized railroad companies.

In such departmental organization the tendency can be avoided of loading on any one division officer the burden of details of various departments, any one of which could be handled well, but responsibility for all of them causes some to be slighted. In a divisional organization the division has to be made a department organization, and there are many who believe it is better to keep each department separate, maintaining harmony between the various departments by the intercourse and conferences of the general department chiefs rather than by trying to keep all in harmony through many divisional department heads. The writer knows that some who for years have advocated and practiced the divisional system are now convinced of the superiority of the departmental system for large and widely spread interests. The general organization as established and developed by our national government seems to combine features best calculated to successfully administer the regulation and direction of the business of a large railroad system.

The above suggestions may be summarized as follows:

1. Departmental system of organization the best for large railroad systems.

2. The board of directors should direct the financial matters of the system and select the best obtainable men to handle the various phases of administration.

3. The executive and administrative officers should be ably and promptly supported in all reasonable calls for financial help to properly equip and organize the system.

4. The board of directors to be divided into small committees, who will meet at stated times, at least monthly, with the head of the department which is especially assigned to them, and keep in touch with the developments and financial needs of that department, granting proper special appropriations for its improvement and development, in harmony with the generally approved policy of improvement agreed upon at the general meetings between the general executive officer and the heads of departments.

5. Select the best expert heads of various departments who will combine executive and organizing ability with technical knowledge of their special department work, and who will command the respect and absolute confidence of the directors and the chief executive.

6. Grant freedom of action to department heads in matters pertaining to the specific details of their department organization, men, methods and quality of materials used.

7. Chief executive officers and department chiefs to have a sufficient staff of able men to relieve them from routine and detail work and also to have a corps of assistants who are free from confining routine work who can be assigned to special investigations of important matters in department work.

8. Able department heads having been selected, leave them unfettered in the government of matters pertaining to their departments, except that they should be kept in harmony with other department work and with the general policy of the company.

9. Pay salaries which will give the system the pick of the best men in the country in their respective lines for department chiefs, and which will retain high-grade men in the service.

10. Place full responsibility and authority on the department officers and let their continuance in office hinge upon their producing successful results.

11. Have a carefully prepared and comprehensive printed schedule defining the jurisdiction of the various departments and the authority and duties of all the officers of the company.

12. Have regular monthly meetings of the department chiefs and the chief executive officer of the company for the discussion of all questions of mutual interest and policy, and for the clearing up of diffiiculties which may have arisen.

13. With a foundation laid as outlined, plan to attract and educate young men so that there may be regular advancement in the service and a corps of men may be developed from which to fill all vacancies in the official staff from those who have grown up in the company's service.

14. Get good men; practice good methods; use good materials, and establish as a fundamental principle the maxim that "Whatever is worth doing is worth doing well."

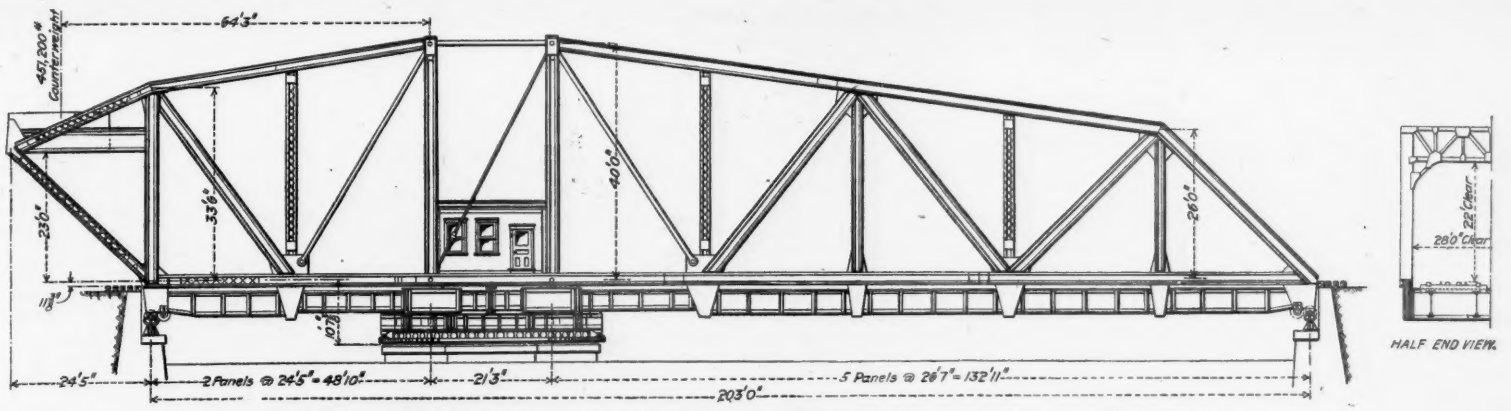
## Counterbalanced Draw Span on the Chicago, Milwaukee & St. Paul.

The Menominee River runs through the City of Milwaukee, Wis., from west to east. Extending south from the river is a system of canals which furnish shipping facilities to elevators and industrial plants occupying a considerable tract along the river. As a result there is a large and constantly growing traffic on the river between its mouth, or confluence with the Milwaukee River, and these canals. The Chicago, Milwaukee & St. Paul Railroad crosses the Menominee on a swing drawbridge at a point quite close to its mouth. It is a 203-ft., double-track, rim-bearing structure, built in 1886 by the Edgemore Bridge Company, and crosses the river at a skew of about 63 degs., allowing a clear channel of 50 ft. The bridge is in first-class condition and fully equal to the demands of present traffic, but the increasing river traffic made a widening of the channel to 75 ft. necessary, requiring the replacement of the bridge by one of increased channel span.

The new structure will have the same length as the old, the increased channel width obtained by a change in location of the center pier to a point 42 ft. nearer the south shore, as shown on the erection plan. The new bridge will therefore be of the counterbalanced swing type, with a long arm 132 ft. 11 in. long, divided into five equal panels, and the short arm 48 ft. 10 in. long, divided into two equal panels. This does not include the portion carrying the counterweight, which extends 24 ft. 5 in. beyond the short arm. The structure is designed to carry on each track two 177½-ton locomotives followed by 5,000 lbs. per lineal foot of track. Other designs, including bascule types, were considered, but the counterbalanced swing design was adopted because of its simplicity and less first cost. Furthermore, the local conditions are such that none of the adjacent property can be used for wharf purposes, requiring no sacrifice of valuable dock frontage. Also, the abutments of the old bridge can be used, requiring only a new center pier.

The small distance between base of rail and high water made the matter of obtaining a satisfactory design for loading the drum, one of considerable difficulty. In the scheme adopted, the load is taken from the tower posts to loading girders, one end of which rests on the drum, the other being connected to a cross girder, as shown in the diagram of method of loading. The weight of the structure, exclusive of counterweight, will be about 650 tons. The counterweight, which will be concrete, will weigh approximately 450,000 lbs. It is placed over the track and projects beyond the end of the bearing, increasing the lever arm and therefore materially reducing the amount of weight needed.

The new center pier is concrete, resting on 4 ft. of

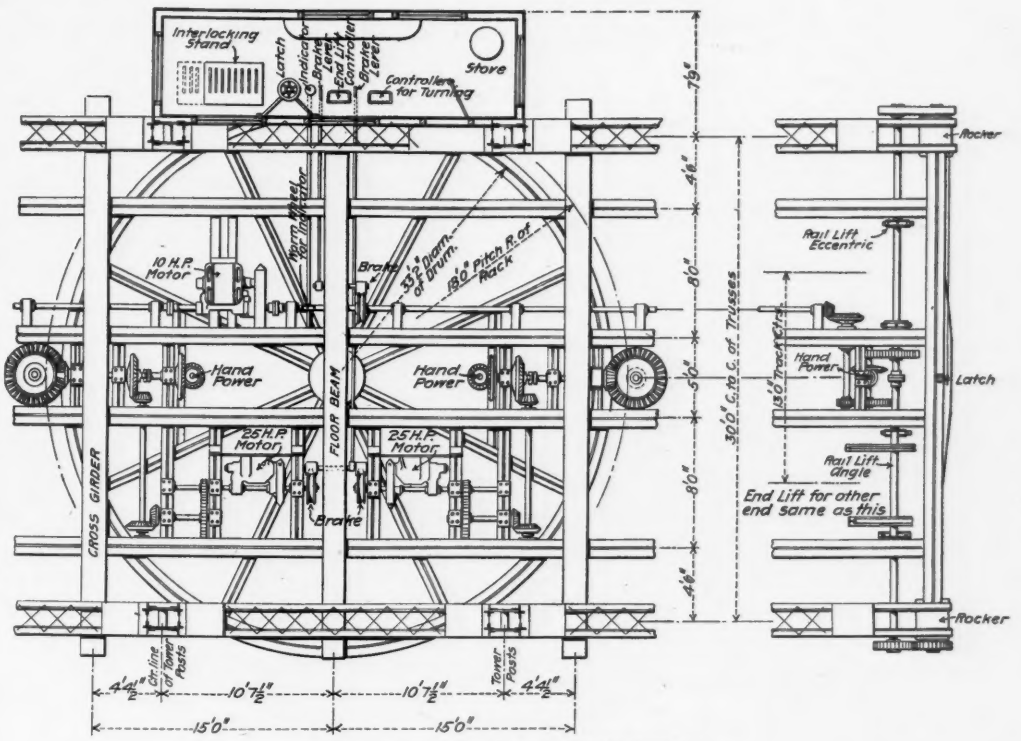



**Elevation and Half End View of Counterbalanced Swing Draw Bridge, C., M. & St. P., at Milwaukee.**

grillage on piles. These piles, which were 75 ft. long, were cut off 16 ft. below the surface of the water and about 8 ft. above the river bottom. Rip rap was placed about them to within 2 ft. of the cut-off. The caisson was assembled in a slip some distance up the river, and after putting in enough concrete to sink the grillage to within about 18 in. of the cut-offs, it was floated down the river, anchored in position and the remainedr of the concrete put in place.

The erection of the new structure presented a difficult and interesting problem, it being necessary to do the work without interfering with either railroad or river traffic. The bridge is only a few blocks from the Union station and the switching and passenger traffic on this part of the line is heavy and continuous. The Menominee River at this point is kept open for the passage of boats the entire year, and a good idea of the amount of river traffic is afforded from the statement that this bridge was opened 9,000 times in 1902—oftener than any other drawbridge on the road.

One of the illustrations outlines the method to be used in erection. Falsework for a single track will be put in between the south abutment and the new center pier and across the latter. The bridge will then be swung clear of the river channel and the north half blocked up on a scow. The south half will then be jacked up, and after placing it on rollers, it will be cut at the bridge center and moved far enough to allow the north arm to be closed. The north arm, with the falsework, will carry the single track which the trains will use during the erection of the new structure. The erection of the new span will be done on falsework parallel to the river channel and the bridge will be in place on its pier, as shown in the plan, the trains passing through its center panel. When erection is complete the north arm of the old span will be swung to the east, jacked up from the protection,




**Plan of Turning and End-Lift Mechanism.**

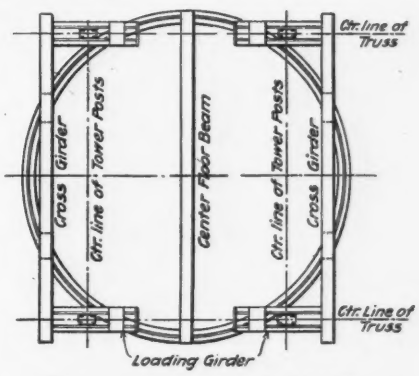
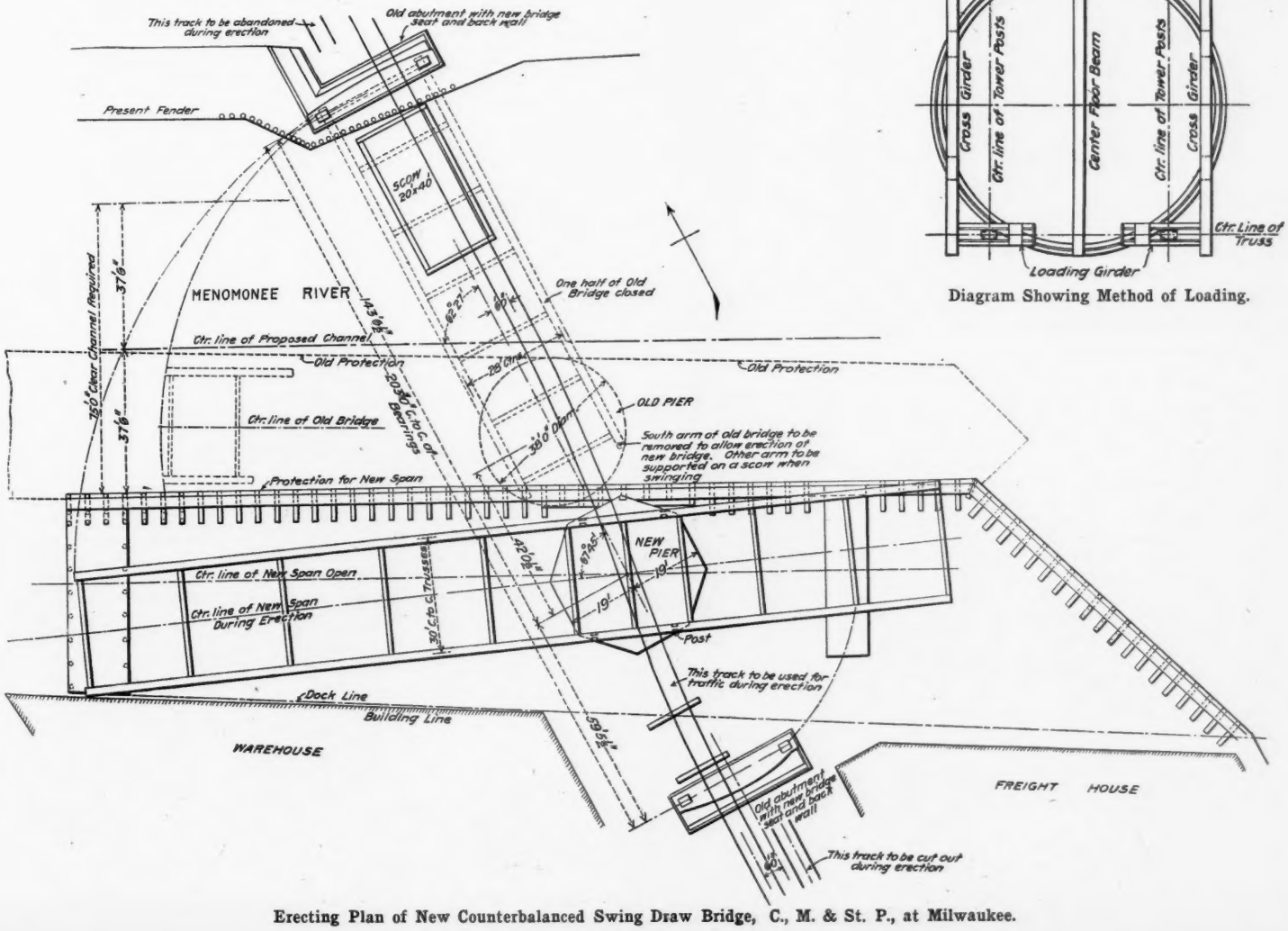



**Diagram Showing Method of Loading.**


This track to be abandoned during erection
Old abutment with new bridge seat and back wall
Present Fender
SCOW 20×40
MENOMONEE RIVER
One half of Old Bridge closed
Ctr. line of Proposed Channel
Old Protection
Old Protection
OLD PIER
Ctr. line of Old Bridge
South arm of old bridge to be removed to allow erection of new bridge. Other arm to be supported on a scow when swinging
Protection for New Span
NEW PIER
Ctr. line of New Span Open
Ctr. line of New Span During Erection
Post
This track to be used for traffic during erection
Dock Line
Building Line
WAREHOUSE
FREIGHT HOUSE
Old abutment with new bridge seat and back wall
This track to be cut out during erection
376'
750' Clear Channel Required
2030' C. to C. of Bearings
30'0" Diam.
30'0" C. to C. of Trusses
19'
19'
59½'

**Erecting Plan of New Counterbalanced Swing Draw Bridge, C., M. & St. P., at Milwaukee.**

placed on rollers and moved far enough to allow the new bridge to close. It is expected to be able to do this between the passage of trains.

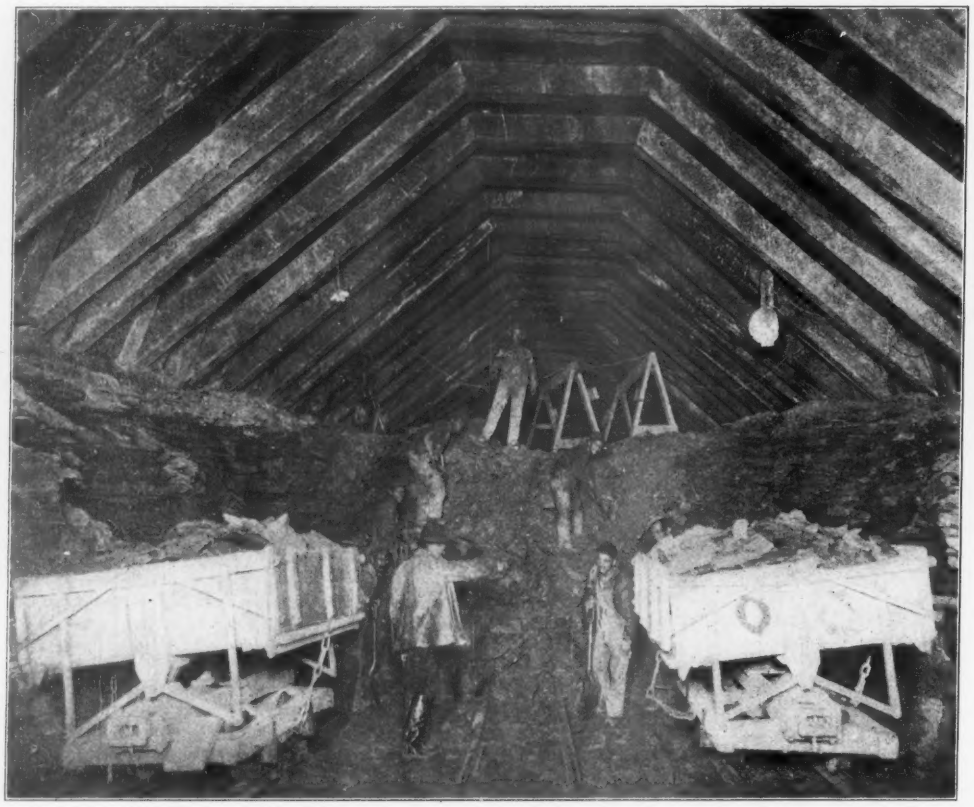
The new bridge will be electrically operated. There will be two General Electric 25-H.-P. street railway continuous-current motors for turning, and one 10-H.-P. motor, located in the center, for operating the rail and end lifts. A plan showing the turning and end-lift mechanisms is included in the engravings.

Work on the center pier is under way and is being done by the company under the supervision of Mr. J. C. Hain, Engineer of Masonry Construction; the company will also erect the superstructure. The steel work is being furnished by the Lassig plant of the American Birdge Company. The plans, both general and detail, were made by the railroad company under the supervision of Mr. J. J. Harding, Assistant Engineer. All of the work is in direct charge of Mr. C. F. Loweth, Engineer and Superintendent of Bridges and Buildings.

East Portal, Greentree Tunnel, showing Approach and Brick Lining.

### The Wabash Extension Into Pittsburg.

The position of the Wabash in years past has been that of a railroad reaching important points in the central West—Chicago, Buffalo, Toledo, St. Louis and Kansas City, but somewhat bottled up by the fact that at each of its important terminal points it has been confronted by exceedingly sharp competition at the hands of rivals with better outlets and inlets in the direction of traffic. In striking at Pittsburg, another route was made into the sharpest kind of competitive territory. The tidewater extension east from Pittsburg would afford the necessary traffic lever, but there is still considerable uncertainty as to the way in which this latter part of the plan will work out. At present, however, the Pittsburg extension opens up a very prolific and valuable local field, and also puts weight behind the desire of the company to secure additional business at other points. Besieged by rivals, arraigned by the city, delayed by the politics of municipal councils, hindered by unexpected natural obstacles and by accidents and strikes, and even peremptorily stopped by the Supreme Court of Pennsylvania, an entrance into Pittsburg has been effected by means of a line 60 miles long to Jewett, Ohio, through extremely difficult country, and the present outlook is that the extension will be open for passenger, express and light freight service about May 1st, or possibly as early as April 15.

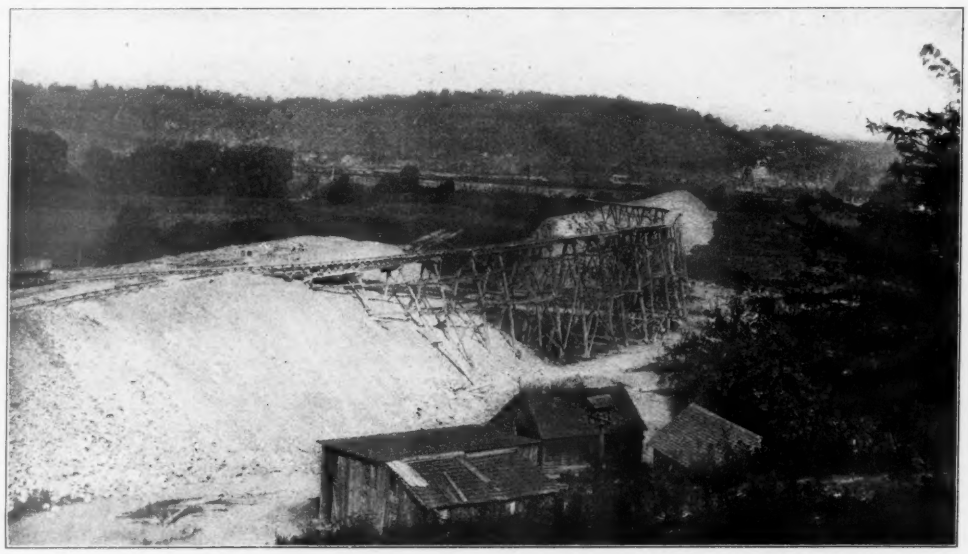


Reinforced Timbering, Mt. Washington Tunnel.

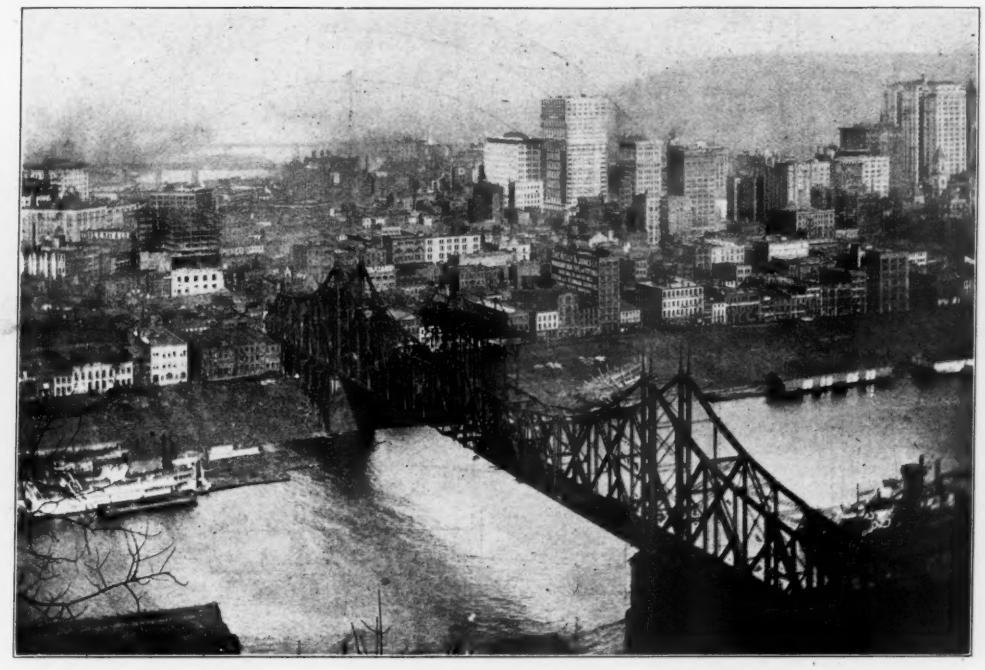
The extension from a connection with the Wheeling & Lake Erie at Jewett, Ohio, to Pittsburg, has been built under the name of the Pittsburg, Carnegie & Western. About 40 miles of track has now been laid, the Monongahela River bridge is practically completed, and the Pittsburg terminal passenger station is well under way. There remain to be built the cantilever span of the Ohio River bridge at Mingo Junction, the elevated line and train shed between the Monongahela River bridge and the passenger station, the tracking of the Greentree and Mt. Washington tunnels and the installation of the telegraph and signal systems. The way stations, trestle filling and other similar work will be done after the line is opened, as will also the construction of the freight branch lines within the terminal limits. With the extension of the Wabash to Pittsburg, the Pacific Express Company's eastern operating terminus will be at that city, while the Wabash extension to Baltimore will give the Pacific Express a transcontinental operating basis.

When Mr. Ramsey was chief engineer of the Pittsburg, Chartiers & Youghiogheny, in 1882, he made a personal survey of a route from Pittsburg to the Ohio River. That was as far as the matter went at that time, however. Late in 1900 the Wheeling & Lake Erie was offered for sale. The Pennsylvania railroad interests were approached in the matter of its purchase, but they refused, seeing no especial advantage because they had already networked the same territory with lines. The Wabash interests took an option on the property, and there was immediately introduced into the Fifty-sixth Congress, then in the closing days of its last session, a joint resolution by the Pittsburg & Mansfield Railroad Company for a bridge across the Monongahela River, within the City of Pittsburg. It was proposed for a railroad upon which electricity was to be the motive power. Fortunately—one might almost say, providentially—the resolution passed both branches. This gave an inlet to Pittsburg for the Ramsey route. That this bridge was intended for the Wabash interests was wholly undreamed of except by those who knew the inside facts of the case. Early in 1901 the Wheeling & Lake Erie deal was closed and work at once began on the extension of this road to Pittsburg, Ramsey and Patterson walking over the original Ramsey route and on from Mingo Junction to Jewett, which portion required a new survey.

The first direct intimation the public had that Wabash interests were backing a project for a new line into the city was an ordinance introduced into Pittsburg City Councils, asking for the right to cross certain streets in the Point and Mt. Washington districts. While this was startling, the dilatory City Councils paid little or no attention to the ordinance, referring it to the "air-tight" corporation committee, where the measure rested undisturbed for almost two years. Meanwhile, the Pittsburg, Carnegie & Western was formed by consolidating the Pittsburg & Mansfield and Washington County Railroad



Fill West of Ohio River, P. T. & W. Ohio River Tunnel (W. Va.) in Background.



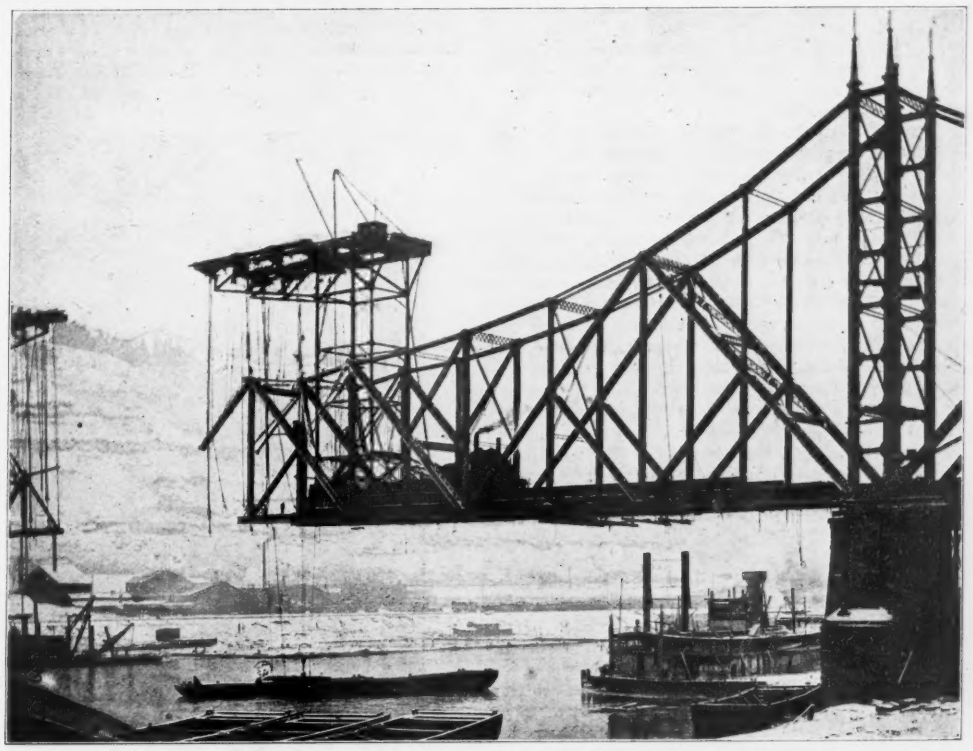
View of Bridge and Passenger Terminal from Mt. Washington.

companies for the Pennsylvania residency of the line. The West Virginia residency was under the charter of the Cross Creek Railroad Company, while the Ohio residency of 20 miles from Mingo Junction to Jewett was known as the Pittsburg, Toledo & Western.

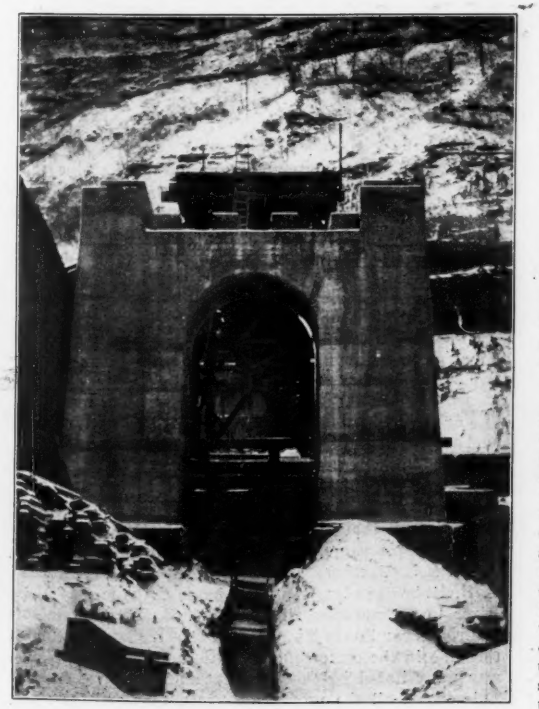
Seemingly disregarding the inactivity of Pittsburg Councils, the Pittsburg, Carnegie & Western went ahead with its purchases of Point district and South Side properties and the construction of piers for a proposed cantilever bridge within the city limits. It bought large and costly plots also for freight terminals. The people looked on this boldness with amazement for some time, and finally the director of public works of the city took the railroad to task, asking for an injunction to have the work within the city stopped, the legal plea being that the railroad had no right to cross city thoroughfares without special permission. The Pittsburg, Carnegie & Western counsel argued that an act of Assembly of later passage gave this permission by allowing a railroad to build between any two points. The Allegheny County Court refused the injunction, whereupon the case was taken to the Supreme Court, from which an injunction was issued, reversing the lower court's decision. This was January 1, 1903. Work in Pittsburg was stopped on that date. Pittsburg Councils had done nothing. A few days prior to this, December 18, 1902, the following letter was addressed to some of the merchants and manufacturing interests of Pittsburg:

Gentlemen: As you are aware, the P. C. & W. R. R. Co. (popularly known as the Wabash) has been for the last eighteen months seeking an entrance into Pittsburg, and that there has been an ordinance pending in Councils to grant the consent of the city of Pittsburg to such an entrance. By a series of mishaps and misunderstandings the ordinance has been so amended as to make it practically useless to the railroad company for the purpose of transportation of freight within the city limits, although it does provide for the construction of a terminal passenger station, and the conduct of a passenger business. The ordinance could be amended upon the lines indicated on the return part of this postal card, so as to permit the railroad to enter the city of Pittsburg, and give its manufacturing and mercantile interests the benefit of transportation facilities over railroad systems operating 16,000 miles of railroad. If you desire to give your aid and sanction to procure for the city of Pittsburg these additional transportation facilities, please sign and return immediately the other half of this card.

Very truly yours,
PITTSBURG, CARNEGIE & WESTERN R. R. CO.,
J. W. PATTERSON, *Gen. Manager.*



View of Construction, North Lever Arm, Monongahela Bridge (Jan. 30, 1904).



Typical Concrete Monolith, with Sewer Trench, for Mt. Washington Drainage.

Fully 90 per cent. of the mercantile and shipping interests were represented in the signatures accompanying the following reply to the letter, which had considerable influence, together with political issue made by the Wabash project, in having Councils take action on the buried ordinance:

To the Select and Common Councils of the City of Pittsburg:

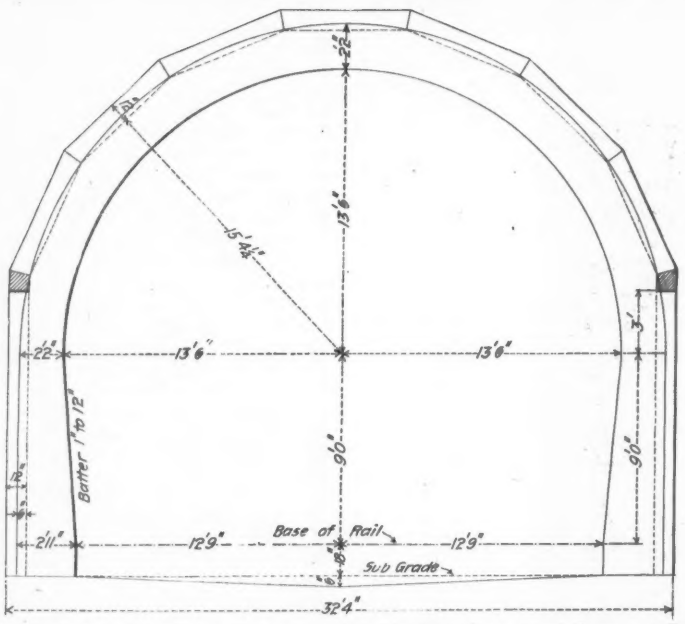
Gentlemen: The undersigned, in order to aid and sanction the entrance of the P. C. & W. R. R. (Wabash) in the city of Pittsburg, hereby respectfully request that such Councilmanic action be taken as to pass the pending ordinances at the earliest possible date, and that in its passage it will be amended so as to permit, 1st, The construction of the South Side branch as an elevated structure along West Carson street between the main line of the company's road and its Robinson-Rea freight station property, and along the bank of the river to a connection with the Monongahela Connecting Railroad; 2d, To eliminate restrictions as to height and construction over Duquesne Way, and permit that matter to be settled by the railroad companies and the city's Department of Public Works; 3d, To permit under the supervision of the Department of Public Works the construction of supporting columns for overgrade crossings at the curb lines and streets crossed. This request is pressed upon Councils generally, and particularly upon our representatives in both the Select and Common Branches.

The ordinance granting the Pittsburg, Carnegie &, Western franchise was passed February 4, 1903, not a stroke of work having been done in the 34 days from the Supreme Court injunction issue. Meanwhile, the railroad had asked the War Department for permission to build a bridge at 50-ft. elevation across the Allegheny River for the connection to be secured with the Pittsburg & Western branch of the Baltimore & Ohio, the charter for which road calls for allowance of other companies to use the tracks upon payment of switching fees to be arranged by a commission. This height of bridge, the river operators claimed, was an impediment to navigation, and a railroad-river interest fight arose that had to be settled by the Secretary of War, all the railroads of Pittsburg being arrayed on one side and the river operators and shippers on the other. All bridges except the Union bridge, at the mouth of the Allegheny, the Secretary decided, should remain at their present height, but the Union bridge would have to be rebuilt so as to give a harbor in the Allegheny for use in times of Monongahela River floods. A few days ago the War Department decided that the proposed Wabash bridge across the Allegheny River, since it was located at about the middle of this half-mile-long harbor, would have to be also at an elevation of 70 ft. The construction and practicability of the bridge at that height being a physical impossibility, the direct line to Allegheny from near the Wabash passenger terminal will be abandoned. An ordinance, now pending in City Councils, provides for a branch freight line along Duquesne way to connect with the Pittsburg Junction Railroad, another branch of the Baltimore & Ohio; this connection will give the Wabash opportunity to reach the manufacturing interests on either side the Allegheny River. The Pennsylvania has been granted an ordinance for a Duquesne way branch to reach the Duquesne freight station in the Point district, close to the Wabash passenger station. This franchise, if signed by the Mayor of Pittsburg, who says he will not sign until the Wabash ordinance is passed upon favorably, will affect the removal of the old freight line of the Pennsylvania in Liberty avenue. The wire-pulling connected with these respective ordinances has been one of the local features of the Wabash-Pennsylvania struggle.

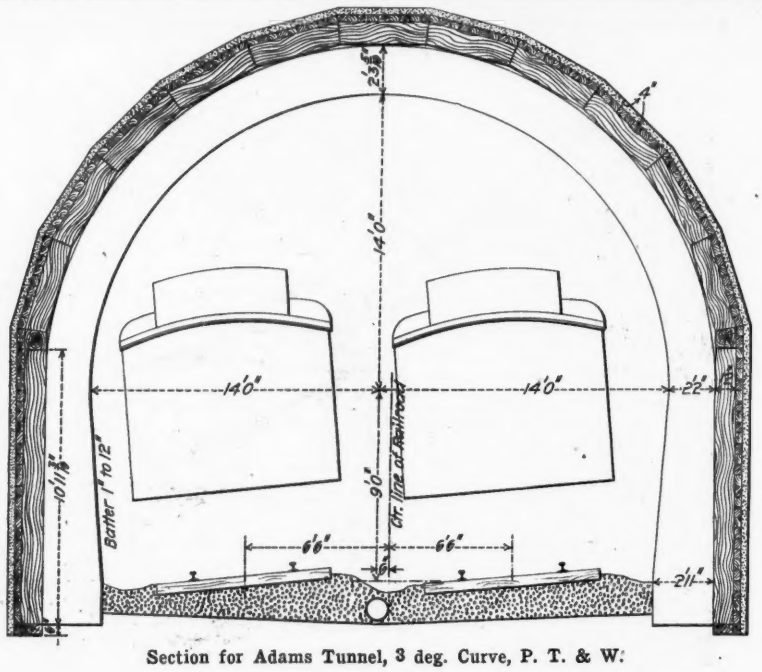
LOCATION OF THE PITTSBURG, CARNEGIE & WESTERN.

The railroad starts at the intersection of Liberty avenue and Ferry street, Pittsburg, and runs westwardly directly over a cantilever bridge crossing the Monongahela River pool by an 812-ft. span at an elevation of 790 ft. above Sandy Hook. Thence the line enters Mt. Washington tunnel almost directly off the bridge. This tunnel is 3,333 ft. long. A short distance out of this tunnel a smaller one, the Bigham, runs through a small hill, that may later be opened entirely by a cut through the 275 ft. of its length. Greentree tunnel, the longest on the line, is reached a short distance from the Bigham, and just beyond the Greentree tunnel is the summit of an ascending gradient from the passenger station four miles back. Within this terminal there is a 5 deg. curve, but this will not affect the train load. The Whiskey Run viaduct is a short distance west from the summit. This is the highest and heaviest on the line and is crossed in 800 ft. on a descending gradient of 0.58 per cent. Thence the line passes through the Borough of Carnegie to Bower Hill, crossing over Chartiers Creek, the Chartiers Railroad and the Pittsburg, Chartiers & Youghiogheny, into Bridgeville, where the P., C. & W. crosses Chartiers Creek twice by viaduct structures. The construction and material yards are located at this point, track laying being done in either direction.

Thence the P., C. & W. starts on a maximum road gradient of 0.7 per cent. through South Fayette township,




Cross Section for Timber and Excavation, Mt. Washington and Greentree Tunnels.




Section for Adams Tunnel, 3 deg. Curve, P. T. & W.

Allegheny County, crossing the Bridgeville & McDonald branch of the Panhandle at Sygan, again at Treveskyn and again a double "Y" of the same road at Cecil. Thence it enters Washington County, Pa., continues to Bishop, the present terminus of the Panhandle's Bridgeville & McDonald branch, where the Wabash line to West Virginia, under the name of the Greene County Railroad, will leave the P., C. & W.

The first tunnel encountered out of Cecil is the Taggart, 800 ft. long, followed by the Hickory tunnel, 320 ft. long, which is at the summit of the line. This is at an elevation of 1,221 ft. Up to and down from this summit the controlling grades are 0.7 per cent., compensated for curvature at a rate of .04 for each degree. McGugin tunnel, 450 ft. long, is west of the Hickory, along the waters of Miller's Run. Thence the line runs along the waters of Cross Creek, which empties into the Ohio River and from which the West Virginia residency gets its name. The line follows this stream to the Ohio on a maximum descending grade through the Craighead and Buxton tunnels (known as the "Twin Tunnels," because they are only 500 ft. apart), which are respectively 1,125 and 930 ft. long. Thence the line is open until the Klein Tunnel, 1,430 ft. long, is reached, the west portal of the tunnel being almost exactly on the State line between Pennsylvania and West Virginia. The line extends thence to a 300-ft. tunnel, the west portal of which is practically identical with the beginning of the cantilever bridge at Mingo Junction. The west portal also marks the end of the Cross Creek Railroad and the beginning of the Pittsburg, Toledo & Western, and is 11 miles from the Pittsburg passenger station. The elevation of the line at the Ohio River is 717 ft. Just after crossing the 700-ft. center span of the Mingo cantilever bridge, the line connects with the Wheeling & Lake Erie branch from Steubenville to Warrenton, Ohio, at a grade of 2 per cent. From the bridge westward through the Mingo bottoms it has been necessary to build a temporary trestle, which is shown in an accompanying photograph, together with a view of the west shore pier of the Ohio River bridge in the background. The whole of the 3,500 ft. of this long fill will be made as soon as the line is opened and construction trains can operate.

Thence the Pittsburg, Toledo & Western continues westwardly up the waters of Indian Cross Creek, encountering first the Ohio River tunnel in Jefferson County, Ohio, and running through Cross Creek and Wayne townships, passing through seven tunnels, ranging up to 1,500 ft. long, to a connection with the Wheeling & Lake Erie main line near Jewett, Harrison County, at an elevation of 1,140 ft. This is the main connection and completes the line from the terminus in Pittsburg.

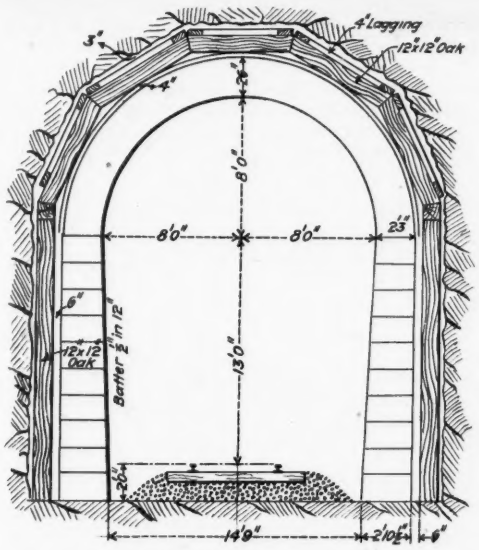
PITTSBURG TERMINAL LINES.

The Pittsburg terminal passenger station is reached from the Monongahela River bridge by a steel trestle, the building being a few yards over four squares from the north anchor arm of the bridge. Three of these city blocks will be taken up with the train shed and with the fan track arrangement leading into the shed and to the proposed Duquesne way freight branch noted above. The passenger station is an irregular triangular structure of nine stories, with steel framing, granite masonry to the first mezzanine floor, stone masonry from this to the bottom line of the third floor and brick with terra cotta trimmings thence to the top. A clock tower surmounted by a dome, the pinnacle of which is 185 ft. from street level, occupies the northeasterly corner of the building over the main entrances. The building faces 175 ft. in Liberty avenue, 195 ft. in Ferry street and 100 ft. in Fourth avenue. This location is on a perfectly level section of the Point district and is just at the edge of the concentrated business heart of the city. The street floor of the building will contain the ticket offices and general waiting room, with doorways leading to the baggage and express departments across Fourth avenue to the south under the train shed. This department will consist of two stories, with ample elevator and driveway service. On a mezzanine floor of the general waiting room floor there will be a restaurant. The second floor of the station will be the main waiting room, leading directly on a level to the train shed, having ladies' rooms, while the mezzanine floor of the second story will contain quarters for employes' washrooms, lockers, etc. The seven floors above will be devoted to offices, where the division quarters of the new line and the other Wabash offices, excepting the city ticket office, will be located, with additional space to be leased to general tenants. The steel framing has been completed and the masonry is done to the third floor. The waiting rooms are to be ready May 1, while the upper office floors will not be completed until late summer.

Completed 50 Ft. Concrete Arch.

Plan of Pittsburg, Carnegie & Western from West Virginia Line to Pittsburg.

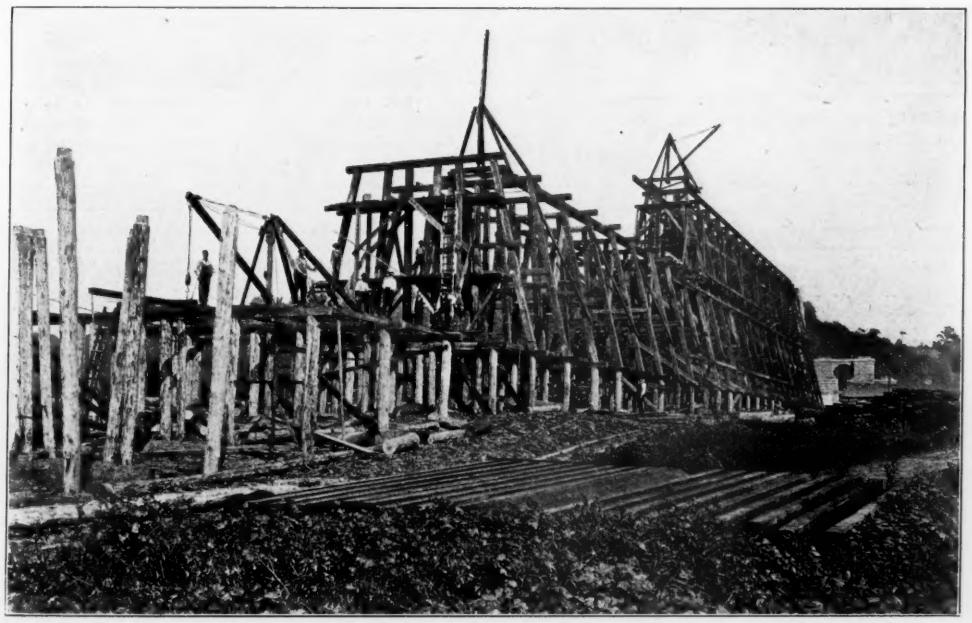
Aside from the Duquesne way branch, referred to above, there are two other freight lines at the Pittsburg terminal. One leads to the site for the terminal freight station and also to reach the factories and mills along the south side of the Monongahela River, including the Jones & Laughlin Steel Company's mills and a connection with the Monongahela Connecting Railroad, and is known as the South Side branch. It will leave the main line of the P., C. & W. at a point just south of the south anchor arm of the river bridge, will curve on an elevated steel structure into the center line of West Carson street, running thence up this street and Carson street by an elevated line past the Pittsburg & Lake Erie terminal stations, will thence curve into the P., C. & W. freight station property and yards, declining to grade, crossing the P. & L. E. tracks, running under the P., C., C. & St. L. R. R. bridge along the south bank of the Monongahela River to a connection with the Monongahela Connecting Railroad near South Twenty-fifth street. The location of this line in the center of one of the public thoroughfares was necessitated by the fact that the Pittsburg & Lake Erie owned all the property between that and the river, for the entire distance between the P., C. & W. line and the freight station and yard site, and the P., C., C. & St.



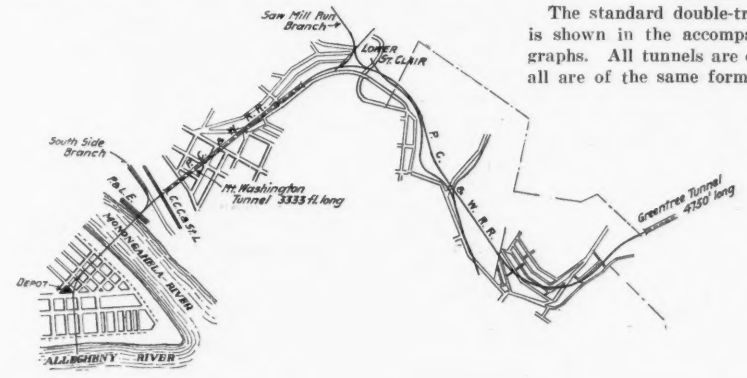

Timber Section, P., C. & W.

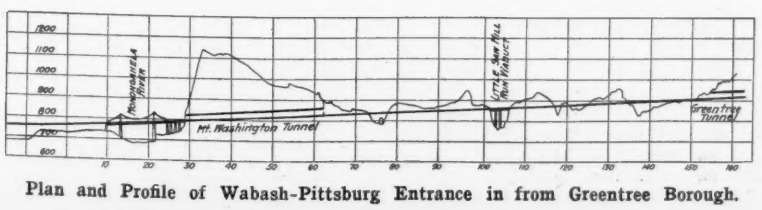
L. R. R. owning all property along the route between the thoroughfare and Grandview avenue, on the brow of Mt. Washington.

While the South Side branch will give opportunity for connection with many of the South Side manufacturing plants, to secure a line for connecting with the Union Railroad (United States Steel Corporation's interplant and terminal line), it has been necessary to build a branch road around the South Side hills. This is known as the Saw Mill Run branch of the P., C. & W., leaving the main line near the south portal of the Mt. Washington Tunnel, running up the Saw Mill Run Valley back of Mt. Washington, reaching the Monongahela River for a connection with the Union Railroad and thus also connecting with the Pittsburg, Bessemer & Lake Erie. This branch, as noted above, is essential to move the large steel tonnage that will be hauled by the Wabash in addition to other heavy tonnage from the Monongahela Valley industries.



Temporary Trestle just West of Ohio River, P. T. & W. Pier of Mingo Bridge in Background.




Plan and Profile of Wabash-Pittsburg Entrance in from Greentree Borough.

FEATURES OF CANTILEVER BRIDGE.

The bridge across the Monongahela River, at Pittsburg, has been described in the *Railroad Gazette*, (March 14, p. 180). The bridge is built for two tracks, being 32 ft. c. to c. of trestles, and is on a gradient of 1 per cent., ascending to the south, or west, as the general line direction is known. The distance from the lowest point of the bridge construction to full pool in the river is 70 ft. The bridge weighs approximately 7,000 tons.

The foundations for the bridge piers are on pneumatic caissons, sunk to bed rock 45 ft. below pool level. All the main piers are constructed of ashlar-faced sandstone, with concrete heart, and are designed to allow a pressure of 200 lbs. to the sq. in. The bridge seats are all granite, allowing for a maximum pressure of 500 lbs. to the sq. in. All other piers and pedestals are concrete monoliths. All bridges on the line are calculated for moving a load on each track of two consolidation locomotives coupled together, weighing 142 tons each and having 160,000 lbs. each on four pairs of drivers, followed by a train load of 4,500 lbs. per lineal foot. As is shown in the accompanying photograph, the Monongahela River bridge is progressing well, most of the riveting remaining to be done. Ties are being laid and rails will be in place before April 1.

The Mingo bridge, which is of a similar type to the Monongahela River structure, has the anchor arms ready and the work on the lever arms has been begun. This bridge is promised by the builders April 15. The Mingo bridge is 1,296 ft. 6 in. center to center of end pins, with a center span of 700 ft. center to center of piers, anchor arms of 298 ft. 3 in. and low water clearance of 90 ft.

CONCRETE ARCH STRUCTURES.

As noted above, the P., C. & W., and particularly the P., T. & W., has considerable concrete construction, there being eight 50-ft. concrete arches on the P., T. & W. alone. One 50-ft. arch supports a bank 188 ft. high. A point of special interest, showing the character of the country, occurs seven miles west of the Mingo bridge, where the Pittsburg, Toledo & Western goes through the 600-ft. Hunter Tunnel, out over a 50-ft. concrete arch and directly into the 400-ft. Oliver Tunnel. There is not one grade crossing of railroad or public highway in the 60-mile line. The total cost of the road, including buildings, etc., will be about $20,000,000.

TUNNEL CONSTRUCTION.

The standard double-track tunnel construction method is shown in the accompanying cross-section and photographs. All tunnels are on the coal measures and nearly all are of the same formation. At some places the subgrade is on the coal vein, at other places slightly above or below, giving fire-clay formation. There was nothing unusual from the ordinary tunnel construction encountered in the line work of the P., C. & W., excepting at the Greentree Tunnel, which, for certain reasons, cannot be detailed at this time. The Greentree Tunnel, taken as a type, as is shown in the cross-section, was made by driving side or center drifts, which started at wall plate grade; putting in wall plates and placing segments as the heading was completed. This was followed by taking out the bench to sub-grade and erecting the plumb posts. A reference to the cross-section of the tunnel will show the relative quantities of heading the bench, as well as the plan of timbering pursued. A uniform breakage of 6 in. was allowed outside the regular tunnel section lining. The lining, some of which has already been done, is in nearly every instance concrete. The accompanying photograph, showing the east portal of the Greentree Tunnel, shows the brick lining used there for the first 500 ft. because of the time of year built. The drainage of the standard tunnel is shown in the cross-section, as is also the size of wall and arch. There are 15 tunnels on the road, and 69 per cent. of the line is on tangents, with a total of only 31 per cent. of curvature. The sharpest curve is 3 degs.

About a year and a half ago the Gould syndicate secured the Ann Arbor Railroad, with its four lines of car ferries operating across Lake Michigan from Frankfort, Mich. These ferries operate to railroads that reach directly into the extensive ore mines of the Lake Superior district. This Ann Arbor line gives the Wabash system a direct ore route and coal line to and from the Pittsburg district, being the shortest haul.

The following comparison shows the relative mileage of the Wabash and the other systems from Pittsburg to Chicago and to St. Louis:

| Pittsburg to Chicago. | Miles. | Pittsburg to St. Louis. | Miles. |
|---|---|---|---|
| P. F. W. & C. | 468 | P. C. C. & St. L. | 621 |
| Wabash | 473 | Wabash | 659 |
| B. & O. | 486 | B. & O. | 669 |
| P. & L. E., via Erie and L. S. & M. S. | 491 | P. & L. E., via Erie & C. C. C. & St. L. | 673 |
| P. C. C. & St. L. | 507 | | |

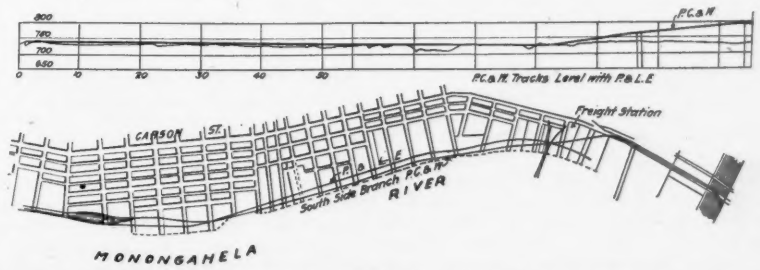
## Seventy-Nine Miles an Hour.

It is reported from Goettingen that in a recent trial of a new high-speed locomotive a speed of 79 miles an hour was attained. The engine was designed by Councillor Wittfeld, of the Department of Public Works, and was built by Henschel & Sohn, of Cassel, Ger. The engine is 88 ft. 6 in. long and is not unlike a vestibule car, for engine and tender are encased in a sheet-iron covering so as to form a single enclosed unit. Everything which might increase the air resistance is avoided as far as possible. The front is pointed and the smokestack only projects 10 in. above the casing. There are three cylinders, the inside high-pressure cylinder driving the front coupled axle, while the two low-pressure cylinders are outside and drive the second coupled axle. In addition to the four driving wheels the locomotive has four-wheeled trucks front and back. The tender is carried by two four-wheeled trucks. All locomotive and tender wheels have brakes operated by air and hand. Two enginemen are carried in the pointed cab at the front end and two firemen in the cab at the opposite end; communication being had by means of a speaking tube. The running boards giving connection between the cabs are underneath the casing. The boiler has 2,766 sq. ft. of heating surface. The tender has a capacity of 5,280 gals. of water and about 7½ tons of coal. The weight of the locomotive is 174,000 lbs. The tender weighs 125,600 lbs. It is designed for a speed of 93 miles an hour with a train of 40 axles. The highest speed was attained on the line between Goettingen and Bovenden, which is about six miles long and fairly straight. In future trials higher speeds are expected, as the first trial was somewhat in the nature of a test of the track. Unfortunately one of the driving boxes ran hot after the first trial. The next test is soon to be made with four or five vestibuled coaches. The locomotive is probably the fastest in the world, and after being tried on the Marien-Zossenfeld military road, where the high-speed electric-car tests took place, it will be sent to the St. Louis Exposition.

## Results of Cleveland-Toledo Electric Service.*

Managers of all high-speed interurban railway properties are watching with great interest the possibilities of connecting up such lines and competing with the established steam roads for what may be considered as the intermediate class of the long-distance traffic. It has been demonstrated in hundreds of instances in this country that interurban lines can not only take from the steam roads a considerable amount of traffic between points 30 miles to 50 miles apart, but actually create a large

*From the *Street Railway Journal*.



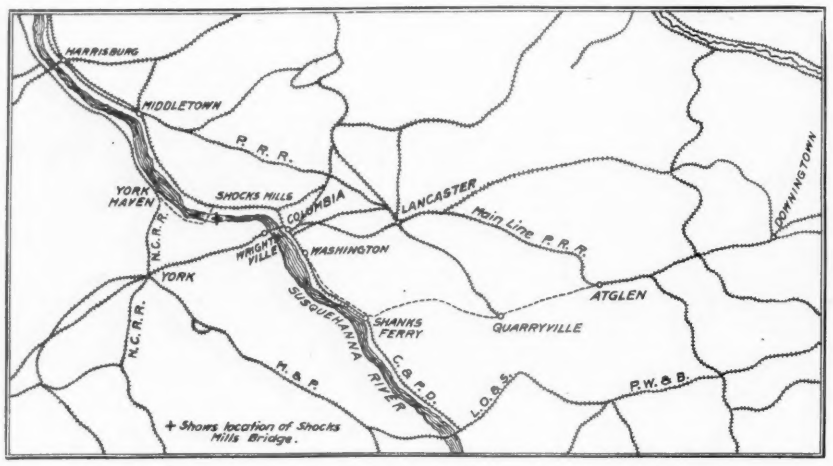

P., C. & W., South Side Branch, Showing Location of Proposed Freight Station.

amount of new traffic under such conditions. But the possibilities of securing a similar percentage of business on lines from 75 miles to 100 miles long are still in doubt. The whole proposition simmers down to the question of whether the frequent service and lower rates of the electric lines can be made to compensate for undeniably the higher speed of the steam lines over such distances.

In view of these existing conditions, it is with interest that this paper is enabled to present the experiences of the Lake Shore Electric Railway in its efforts to secure a portion of the through business between Cleveland and Toledo, a distance of 118 miles.

Before going into these figures, however, it is well to consider carefully a number of mitigating circumstances which have undoubtedly prevented this company from making as good a showing as it might have done, or will in the future, as well as conditions which will probably not be found with other companies similarly situated for long-distance traffic.

During eight months in the year there are daily steam-




**Map of Pennsylvania Lines Between Harrisburg and Downingtown, Pa.**
*New Low-Grade Line is Shown by Dotted Line.*

on the electric line is $1.75, and no extra charge is made on the limited.

As the result of the Everett-Moore embarrassment, the Lake Shore Electric was placed in a receiver's hands just after the lines which make up the through system were physically connected. For months the power equipment and rolling stock were indifferently maintained, owing to necessary retrenchments, and the service could not be relied upon. Furthermore, it was necessary to change cars at two points. These conditions, however, have been greatly improved during the last few months, and the schedule was reduced from 7 hours to 6 hours, and was better maintained. It is only within the last three or four months that cars have been run through without change.

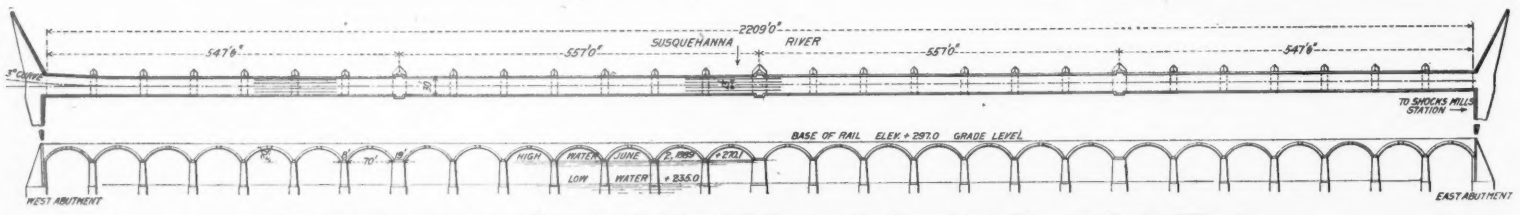
About the middle of October the company installed the limited cars mentioned, and a pronounced increase in through traffic was at once noticeable. In November an accident to the power station necessitated the withdrawal of the limited cars and the reduction of regular cars to 2-hour headway. This condition extended over into December, particularly traveling men, who wish to visit the intermediate towns, buy tickets from town to town and stop over a car to see customers. In this way it is possible to cover six good towns and only spend a day on the trip from Cleveland to Toledo. It is safe to figure that if an accurate record of these various classes could be obtained they would more than double the so-called through traffic:

| | Tickets sold, Toledo to Cleveland. | | | Tickets sold, Cleveland to Toledo. |
|---|---|---|---|---|
| 1903. | Single. | Excursion. | Total single trips. | Total single trips. |
| January | 439 | 51 | 541 | 498 |
| April | 487 | 83 | 653 | 498 |
| June | 532 | 55 | 642 | 555 |
| August | 779 | 101 | 981 | 804 |
| October | 870 | 124 | 1,113 | 1,074 |
| December | 730 | 198 | 1,126 | 1,181 |

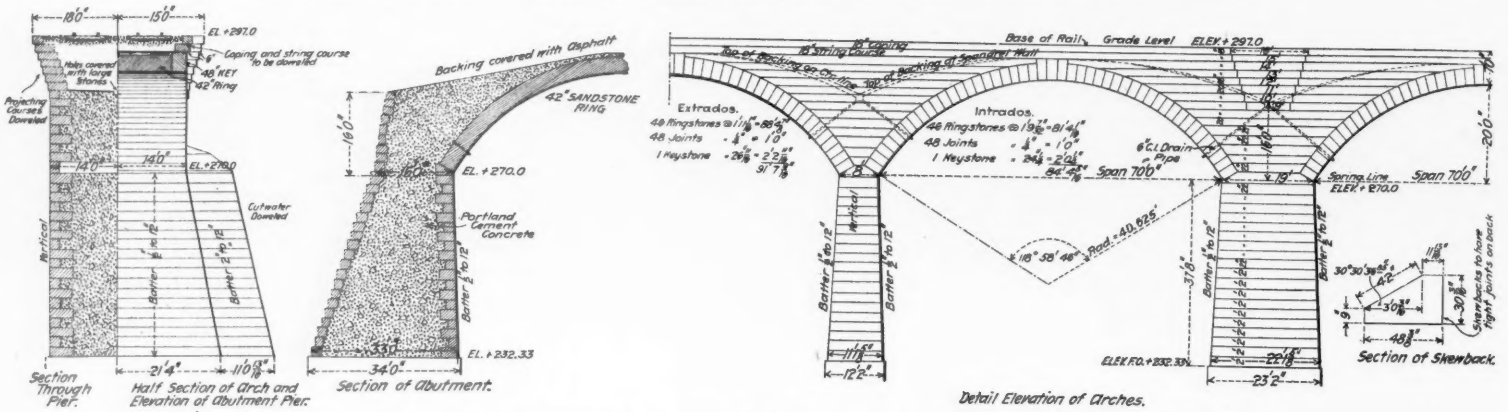
The officials of the company figure that the new limited cars are a most profitable feature of the service. They cost no more to operate—possibly a trifle less than the regular cars in view of the less frequent stops—and they are earning a trifle over 40 cents per car mile, as compared with an average for all cars, including the limits, of 22 cents per car mile.

## Pennsylvania Low-Grade Line Down the Susquehanna.

The very serious congestion of traffic on the Pennsylvania between Pittsburg and tidewater which prevailed for the greater part of last year showed the necessity of the policy of that road in planning and carrying out extensions, new lines and yards and other permanent improvements on a tremendous scale, apparently regardless of cost. The existing lines over the mountains and down to the Atlantic ports proved inadequate many times and the blockades of freight were a source of loss and inconvenience difficult to even estimate at money value. Insufficient yard room at terminals and intermediate points was perhaps the chief cause of the frequent congestion, but there were also many delays along the line because of limited tracks in the open. That the situation had been foreseen and carefully planned steps taken to relieve and prevent such over-taxing of existing lines is evidenced by the fact that work had already been commenced and even

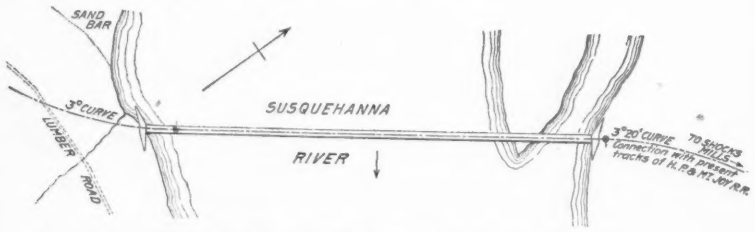



**Side Elevation and Plan of Pennsylvania Railroad Bridge over the Susquehanna River at Shocks Mills, Pa.**

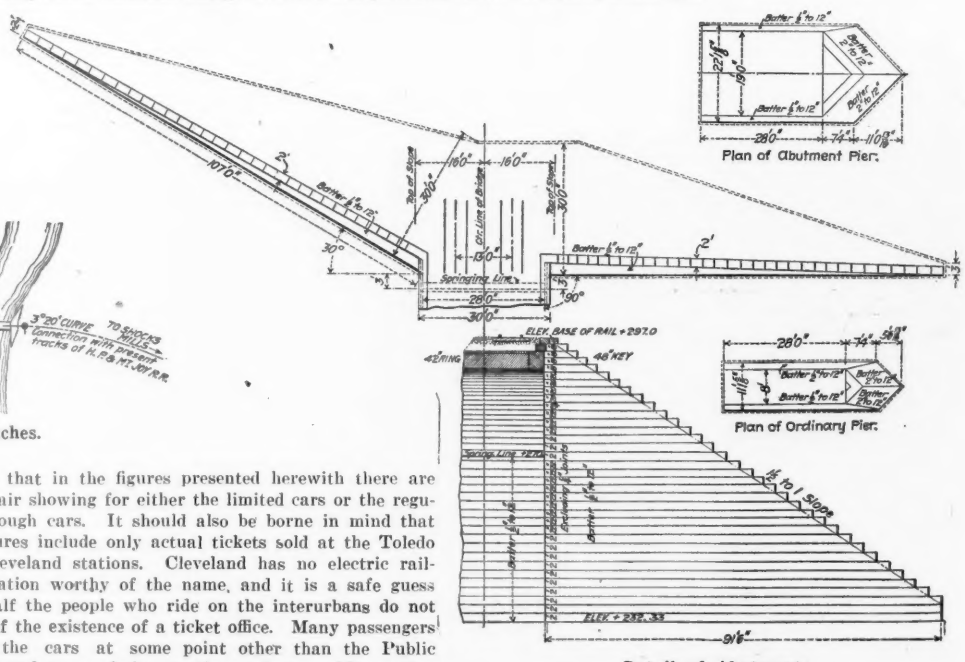



**Details of Arches and Piers in Pennsylvania Railroad Bridge over the Susquehanna River at Shocks Mills, Pa.**

ers between Cleveland and Toledo which are well patronized, as it is a pleasant trip and the fare is low. For a steam competitor the company has the Lake Shore & Michigan Southern, giving high speed and frequent service over a route which is nearly 10 miles shorter than that of the electric road. The fastest trains make the distance in 2 hours and 35 minutes, while the ordinary




**Plan of Bridge Showing Location and Approaches.**




trains require 3 hours and 30 minutes. The fare on the steam road is $3.25. It should also be stated that in both cities it is necessary for steam railroad passengers to take street cars to reach the business districts, which increases the time as well as the fare, as compared with the electric line, which touches the centers of both cities, and incidentally gives transfers good on the city lines. The schedule of the electric line is 6 hours for the regular cars and 4 hours and 30 minutes for the limited cars, which leave the terminals morning, noon and evening. The fare

ber, so that in the figures presented herewith there are not a fair showing for either the limited cars or the regular through cars. It should also be borne in mind that the figures include only actual tickets sold at the Toledo and Cleveland stations. Cleveland has no electric railway station worthy of the name, and it is a safe guess that half the people who ride on the interurbans do not know of the existence of a ticket office. Many passengers board the cars at some point other than the Public Square and pay cash fare to the conductor. Many other

completed in some sections on what is practically a new double-track low-grade line over the mountains and in many places a complete relocation, with change of grade and alinement, of the present main line and its numerous detours and cut-offs. A general survey of these proposed and recently completed improvements was printed in the *Railroad Gazette*, March 13 and 27, 1903, pps. 178 and 221.

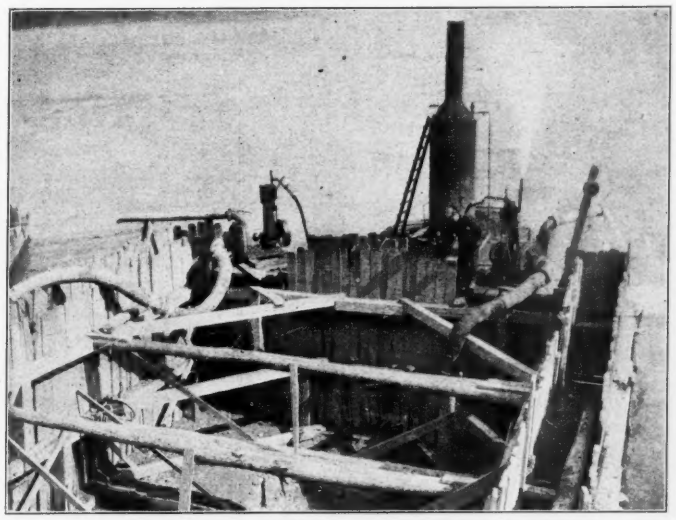
One of the most important of these numerous new lines and improvements is the low-grade double-track freight line from a point three miles below York Haven, on the Northern Central, across to a point on the main line near Atglen, 58 miles east of Harrisburg. This is part of the general plan to eventually have a double-track freight line to tide water with limiting eastbound grades of 16 ft. When the whole project is completed, trains will be taken out from the Marysville yard, located at the west end of the new Rockville bridge across the Susquehanna above Harrisburg, and run down the west bank of the river over the tracks of the Northern Central to York Haven. The new line begins about two miles south of York Haven and continues on down the west bank of the Susquehanna, 4 miles, to Codorus Creek. Just beyond this point it turns on a 3 deg. curve and crosses the Susquehanna on a new stone bridge of 28 arches, turning down the river on the other side on a 3 deg. 20 min. curve to a connection below Shocks Mills or Rowenna with the Harrisburg, Portsmouth & Mt. Joy, one of the Pennsylvania's acquired lines running down the east bank from Harrisburg to Columbia. Below Columbia the tracks of the Columbia & Port Deposit will be used for the present to a point between Washington and Creswell, although ultimately a new line will be built down the center of the old Pennsylvania Canal property between Shocks Mills and Creswell. At Creswell the new line begins to ascend the river hills on a long, easy grade, keeping parallel to the river until Shank's Ferry is reached. Conestoga Creek, near its junction with the Susquehanna, is crossed at a height of 125 ft. above the water. Beyond Shank's Ferry the line turns almost due east, crossing Pequea Creek at Martic Forge at an elevation of 110 ft. and continuing on to Quarryville, the southern terminus of the Lancaster and Quarryville, which is owned by the Pennsylvania. East of Quarryville the new line is practically straight to Atglen on the main line. The total distance between Marysville and Atglen by the new route is 72 miles, or nine miles longer than the main line. With the exception of the curves on the approaches of the Shocks Mills bridge, one of which is 3 deg., 20 min., the limiting curvature is 2 deg., and the limiting eastbound grade 16 ft. per mile; the ruling westbound grade is 32 ft. per mile. The road will be built and equipped in the most substantial manner with 100-lb. rails, automatic signals and water troughs.

Beyond Atglen to Thorndale, 9 miles, grades on the main line will be reduced to 16 ft., and from Thorndale to Paoli, 15 miles, a new double track line will be built, practically paralleling the main line, with easy grades and curves. At Glen Loch a connection is being built to the Trenton cut-off, giving an independent low-grade freight line between Harrisburg and the New York Division above Trenton, N. J. The whole improvement between Paoli and Marysville will cost when completed about 20 million dollars, or $300,000 a mile.

The work on the section between York Haven, on the Northern Central, and Shocks Mills, on the Harrisburg-Columbia branch, including the Shocks Mills bridge, is well under way and will probably be completed this summer. Along the west bank the work has been of ordinary character, side hill cutting and burrow pit embankments, but on the east bank, below Creswell, the work has been exceptionally heavy, consisting of a long side hill cut in the rocky bank from 50 ft. to 100 ft. above the level of the Columbia & Port Deposit tracks which skirt the river bed at the foot of the hills. Work was stopped last July on account of the large quantities of rock and debris which continually slid down the bank and blocked the tracks below after being blasted loose. It was expected at the time to renew operations in the fall when traffic on the Columbia & Port Deposit would not be so heavy and the danger from slides not so great. The work was abandoned for the winter, however, and will probably not be resumed until the early summer. Along with the stopping of work between Creswell and Shanks' Ferry work was stopped between the latter point and Atglen and between Thorndale and Paoli. This also will be resumed in a few months and finished as soon as possible. After the completion of the line from York Haven to Shocks Mills on the Harrisburg-Columbia branch and pending the completion of the rest of the cut-off, trains will be run over the new line to Columbia and thence over the Columbia & Lancaster branch to the main line. Another route is down the Columbia & Port Deposit to Dorsey's, Pa., the junction with the Lancaster, Oxford & Southern, or on down to Havre de Grace, Md., to a connection with the Philadelphia, Baltimore & Washington, over either of which routes trains can be brought into Philadelphia or Baltimore.

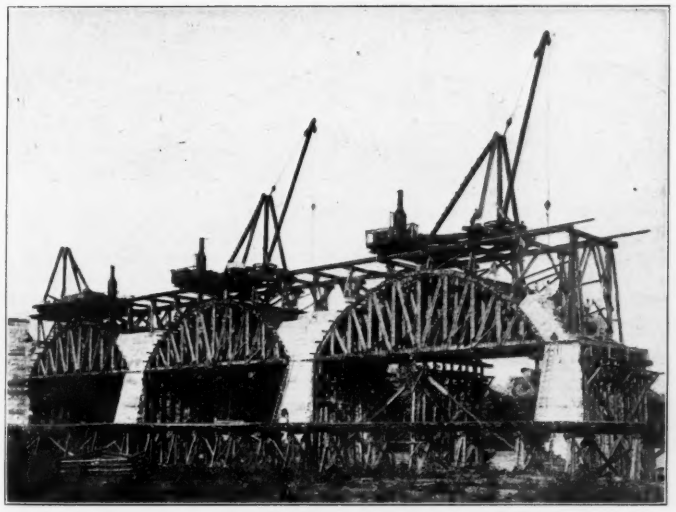
The most interesting single piece of work on the new line is the stone bridge across the Susquehanna at Shocks Mills. It is generally similar in design and appearance to the recently completed bridge on the main line across the same river at Rockville, above Harrisburg, which was put in service March 30, 1902, and to the bridges across the Delaware at Trenton and across the Raritan at New Brunswick, N. J. The policy of the Pennsylvania in all of the new improvements now under way or planned for the future is to make them of the most modern and substantial character and to this end wherever it has been possible masonry arch bridges have been put in instead of steel spans.

The Shocks Mills bridge is 2,209 ft. long between abut-



Coffer Dam for River Pier Foundation.

Placing First Arch Center in Position.



Turning the Arches, East End.

Present Stage of Construction, Looking West, Showing Ice Gorge Formed Jan. 24.

Ice Gorge About 50 Ft. Deep, Formed Feb. 23.

ments and is composed of 28 stone arches, each of 70 ft. span and 20 ft. rise. They are divided into four groups of seven arches each, separated by heavy abutment piers. The arches are circular, turned on a radius of 40,625 ft. and including an angle between skewbacks of 118 deg., 58 min., 46 sec. The width of the arch ring is 28 ft. and the width of the bridge over copings is 30 ft. At the east end the approach is on a 3 deg., 20 min. curve and at the west end on a 3 deg. curve. The tangent point on this end is on the bridge about over the first pier and arches 1 and 2 are widened by extending them on the upstream side, the downstream faces remaining in the same line as the other arches. The west abutment is modified slightly to accommodate the increased width of the adjacent arch, but in general is similar to the east abutment shown on the drawing. The grade on the bridge is level.

The river bed at this point is 13 ft. below the low water mark, El. 235, above sea level, and the maximum high water, recorded June 2, 1889, is El. 270.1, one-tenth of a foot higher than the springing line of the arches in the bridge. The concrete foundations for the piers and abutments were sunk with open coffer dams made with inner and outer walls of sheet piling, calked in between with clay filling. One of the photographs shows the coffer dam still standing around a completed foundation for one of the river piers. The piers are stone-faced and backed with large stones laid in Portland cement concrete. The facing is laid in alternate courses of headers and stretchers, 2 ft. thick for the first ten courses and 1 ft. 10 in. thick for the remaining courses up to the skewbacks. On the downstream face, the piers have no batter, but on the two transverse faces they have a batter of 1 in 24. The nosing faces on the upstream side make an angle of 45 deg. with the center line and have a batter of 1 in 6.

The abutments are also stone-faced, front and back, with concrete filling. The foundation extends back 34 ft. and the rear wall is built up with range work to give a thickness at the spring line of 16 ft., the front face being alternate courses of headers and stretchers, with a batter of 1 to 24. On the upstream side the wing wall makes an angle of 30 deg. with the face of the abutment and extends back 107 ft. It is built up in regular courses and is stepped down from the level of the coping with a slope of 1.6 to 1. It is 2 ft. thick and has a face batter of 1 to 24. The downstream wing wall is at right angles to the center line of the bridge and extends out 91 ft. The abutment foundation is roughly speaking diamond-shaped, tapering to the ends of the wing walls and having a maximum width of 34 ft.

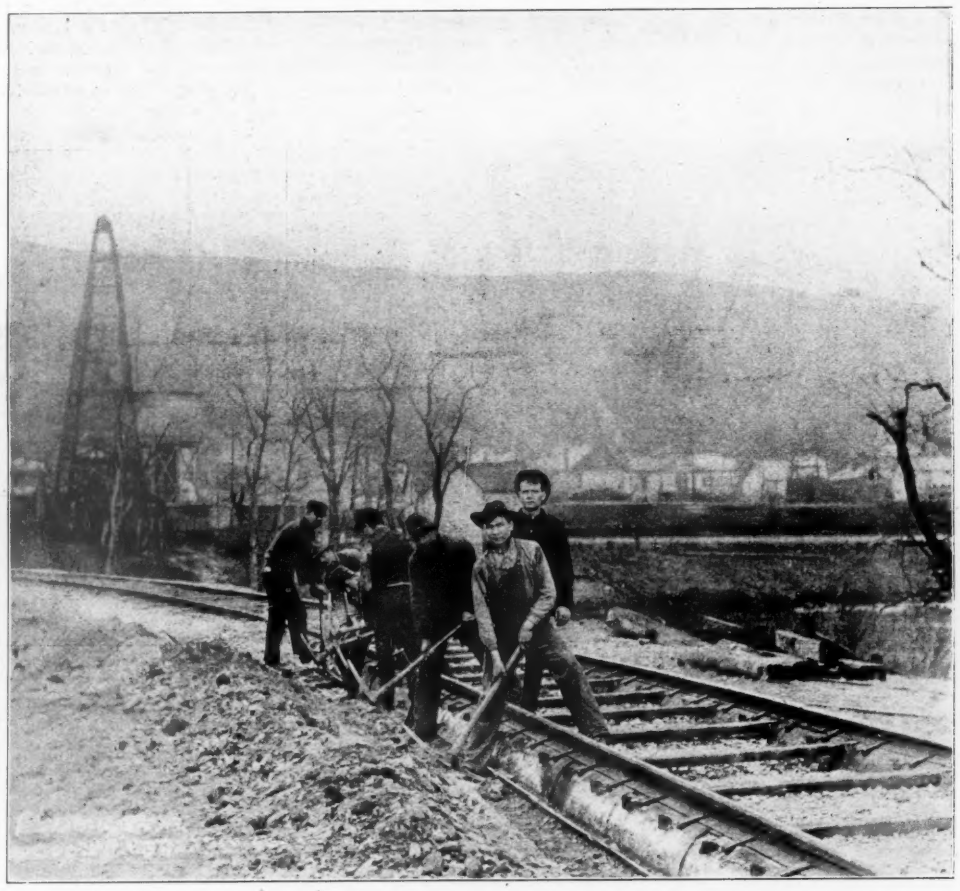
The arches are composed of 42-in. rings of sandstone, made up of 46 ring-stones and one keystone, laid with ¼-in. joints. The spandrel walls are carried up flush with the ends of the arch rings in courses varying in thickness from 22 in. to 18 in., except over the abutment piers on both sides where the middle stones of the top eight courses are laid to project out beyond the arch ring to form safety niches, 3 ft. wide and 16 ft. long. These projecting stones and the coping and string courses are all doweled in. Concrete backing is laid between the spandrel walls and over the arch ring, 16 ft. deep over the center of the piers and tapering down in thickness over the arch, being flush with the bottom of the string course at the crown. Drainage is provided for by 6-in. cast-iron drain pipes run down through the spandrel backing and passing through the fourth ringstone. The spandrel backing is asphalted for a waterproof covering and the broken stone filling is laid in on top, there being about 36 in. of filling and ballast over the crown of the arch.

Work was started from the east end and before the ice began to run in the river the piers for the 14 arches comprising the east half of the bridge were completed and the arches themselves placed. The photograph taken Jan. 24, shows the appearance of the work as far as it has progressed. The approach is partly filled in behind the completed wing walls of the east abutment and the first four arches are finished, including the spandrel walls, coping and string courses. The remainder of the arches out to the first abutment pier are completed with the exception of the string course and coping and the centering has been removed. All of the arch rings in the second group have been set and the spandrel walls built up to within two or three courses of the top. The centering is still in place however.

In building the bridge, the pier and abutment foundations were first completed for each group of arches and then the piers were built up to the skewbacks. Most of this work was done during the low water period of the summer and early fall and the stones in the abutment, wing walls and in-shore piers were handled by derricks erected in the river bottom which unloaded them from cars standing on a trestle built out in the river alongside the bridge site. When the piers had been completed up to the skewbacks the centers for the first three arches were put in place and the work of setting the arch rings begun. Pile bents were driven in on each side of the piers and across the tops of these was bolted a cap sill. The ends of the arch centers were supported on a sill girder resting on blocking on top of the cap sill, thus providing the necessary adjustment. The arch centers were made up of wooden trussed ribs, sway braced together transversely. The ribs for the arch center next to the abutment were put in place by the derricks used in building the abutment and wing walls and after they were properly secured a wood trestle work for the traveler was built out to the first pier, being supported on posts under each track girder, resting on the pier and the centering ribs. The traveler was used for erecting the centerings for the second and third arches and when these were in place the setting of the ringstones was started simultaneously, on the three arches, a traveling derrick being mounted on the trestle over each arch. The centers and piers were substantial enough to permit of the placing of the spandrel walls at the same time and the first group was practically completed before the second group was begun.

The completed portion of the bridge has had a very severe test during the past winter in resisting the tremendous ice gorges which have formed in the Susquehanna. The illustration from a photograph taken on Feb. 23, shows the gorge formed above the bridge. It extended about 20 miles above and below the structure and at this point was nearly 50 ft. deep. The ice pack rested on the bottom of the river as nearly as could be ascertained and it was piled up solid to the springing line of the arches. In spite of the severe strain on the bridge, no defects of design or construction have developed.

The contractors for the bridge and the section on the west bank of the river are H. C. Kerbaugh & Co., Inc., Philadelphia. The plans for the bridge were prepared under the supervision of W. H. Brown, Chief Engineer of the Pennsylvania, by E. B. Temple, Assistant Engineer, and the construction work is being carried out under the supervision of George Nauman, Assistant Engineer. We are indebted to Mr. Brown for the drawings and much information.



Ballasting Around Inverted Steel Trough.

## Steel Railroad Substructure.

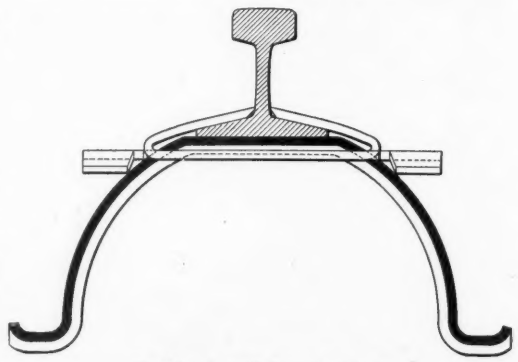
The system of supporting railroad rails on a continuous line of inverted trough-shaped girders, as illustrated in the accompanying drawings and photographs, is designed particularly to evenly distribute on the roadbed the concentrated loads of the wheels as they pass along the rails. The trough-shaped girders are combined with tie pieces and rail fastenings, the girders affording the bearing area necessary for the proper distribution ot the load and the other parts uniting to provide the rigidity, facility of application to the track and cheapness of manufacture required to make the system commercially possible.

A special claim for the system is that it provides a continuous support for the rails, thus preventing the deflection of these rails between the separated points of support as furnished by the common cross-tie system. The concentrated wheel loads are distributed over a large area, equal to the width of each girder multiplied by its length, and the rail is not required to act as a beam. The bearing area, and therefore the supporting power of the system, can be easily increased if the increased wheel loads demand it, by adding to the width of the girder, whereas the bearing power of the ordinary cross-tie system is limited by the necessity of so spacing the ties as to admit of the supporting material being properly tamped beneath it. A rigid fastening is also provided for the rail without the use of bolts, with continually loosening nuts; spikes, or the many forms of tie plates, rail braces, etc., all of which add considerably to first cost and to maintenance of the track.

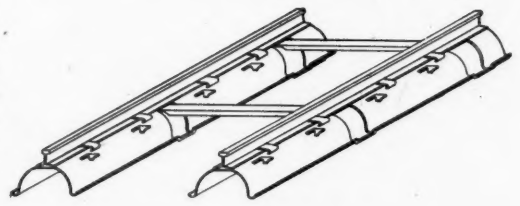
The girders are 7 ft. 6 in. long, or one-fourth of the ordinary rail length, allowing the rail joint always to be placed in the center of a girder. The shear between rail ends is therefore entirely taken up by the supporting girder, and there is no necessity of providing for it by a heavy angle-bar splice. Springing of the rail ends is also entirely prevented and the battering of the same is reduced to a minimum.

It is claimed that the form of the girder is such as to allow the ballast of gravel or broken stone to be as easily and cheaply applied as in the present cross-tie system and with greater efficiency, because a larger mass is acted upon by the passing loads and the deformation of the track is thereby decreased.

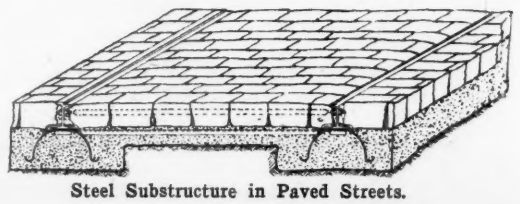
The system is composed of three members or parts only; the girders, tie plates and clips. All girders are exactly alike and can be applied to curves as well as to straight track, the slip joint between them permitting adjustment to curvature. The tie pieces also are all exactly alike and the clips are all alike except those used at rail joints, which are slightly altered on account of the interference with the angle-bar rail splice. It is also claimed that the forms of all the parts are such that they can be made cheaply from plates of rolled steel or other suitable material, without the use of special shapes, and that no costly or special tools are required for applying the sys-



Detail of Duff Trough Girder.



Perspective, showing Method of Tying.



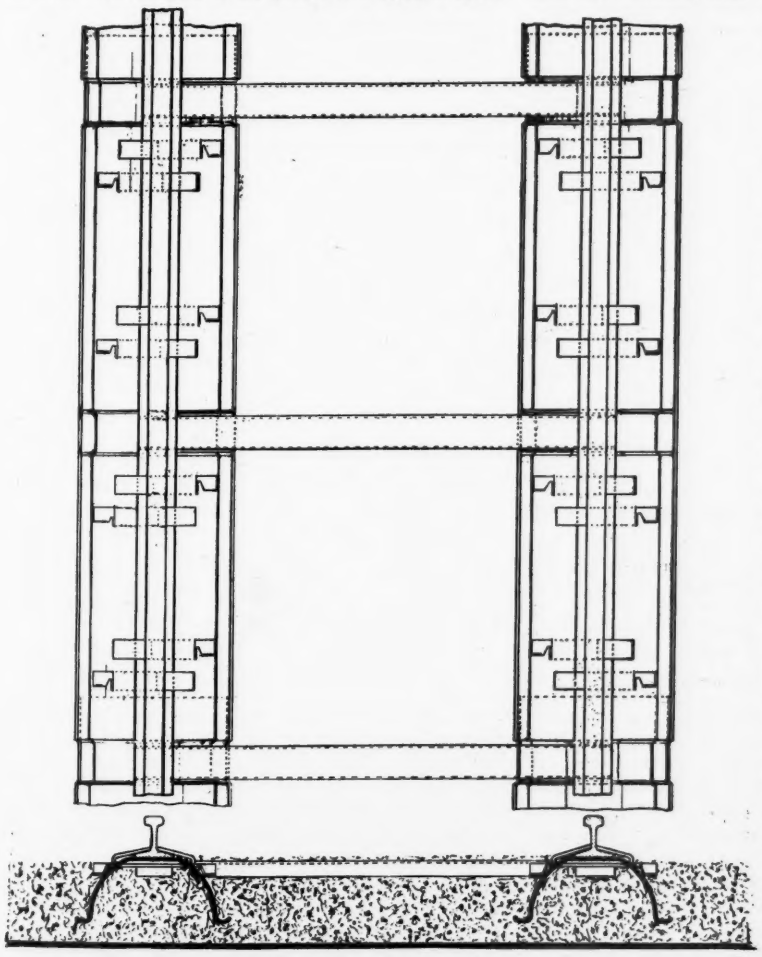
Steel Substructure in Paved Streets.

tem to any railroad. Superiority over the cross-tie is also claimed on the ground that when the parts of the system reach their limit of usefulness by means of increased loads, deterioration, rust or other causes, they will still have a money value as scrap.

The drawing reproduced herewith shows a perspective view of two girders with tie pieces, rails and clips, in position, and the ends of the next pair of girders are also

**Duff Pressed Steel Substructure—Forbes Street, Pittsburg.**

indicated. A plan is also shown of two girders, complete with tie pieces, rails and clips, and a cross-section of a girder is shown supporting rail of 100 lbs. section with rails clips in position. To apply the trough girder system the roadbed is prepared in the same manner as for ordinary construction and leveled off at the elevation fixed for the bottom of the ballast. The ballast is placed over the area to be occupied by the girders to a depth of about 3 in., or whatever is necessary to bring it to the height of the bottom of the girders. The girders and tie pieces are then placed in position and the tie pieces act as spacers to maintain the required gage. While the girders are being laid down, the ends of each succeeding pair are lapped over the ends of the immediately preceding pair by means of the slip joint, and as much ballast as can conveniently be thrown into the girder from the ends is placed within them. In laying the rails care is taken to have the joint occur at about the center of the girder. The rail clips are then inserted in the girder openings and the ends of them are bent down to form a lock. Ballasting is completed by tamping in under the sides of the girders until they have a firm and even bearing. While the tamping is being done the track can be brought to the required alinement and elevation, after which the ballast can be placed between and outside the girders to complete the roadbed to the desired form.



**Plan and Section, showing Method of Tying and Steam Road Ballasting.**

The steel substructure is also adapted to street railroads, as shown in one of the photographs. The girder running parallel with the rails reduces to a minimum disturbance of the pavement that always occurs when the track is laid on cross-ties, caused by the movement of the ends of the ties when the load passes along the track and tending to break up the surface of the pavement. When it is necessary to remove the rails this can be done without disturbing the girders or foundations in any respect by straightening out the ends of the clips, after which the old rails can be removed and replaced with new ones.

In laying track on steel substructure it is not necessary to excavate to the whole depth for the entire length of the roadbed, but only underneath the girders, allowing sufficient width at each girder to permit the ballast to be easily tamped underneath. Forcing the ballast under the girders to give it a uniform bearing is performed without difficulty by tamping along the lower edges of the girder. The best material for ballast is gravel or broken stone, but if a concrete foundation is desired the form of the girder is such that the concrete is made to properly distribute the loads while the shocks of the passing traffic are taken up by the top of the steel girder, obviating the greatest cause of trouble met with in other forms of concrete track support, that the shocks of passing traffic quickly break up the concrete into separate pieces and disturb the continuity of the structure.

The use of straight girder sections of uniform type is feasible on any curve having a radius of 500 ft. or over. On curves of less than 500 ft. radius, however, such as are bound to occur in street railroad work, special curved sections are used. It is not necessary to have the radius of these curved sections exactly the same as the radius of the curve where they are applied, since the clearance at the ends permits a variation in this respect by means of a slight adjustment of the clips.

Notwithstanding the high first cost, it is claimed that the necessary continued renewal of track, pavement and rolling stock under the cross-tie system of track laying, leaves the steel substructure ultimately the cheapest form of construction, besides obviating the confusion and delay in traffic occasioned in crowded metropolitan districts by tearing up and moving cross ties, rails and pavements every few years.

The steel railroad substructure was designed by Samuel E. Duff and is made at the Allegheny Works of the Riter-Conley Manufacturing Company, Pittsburg, Pa., of which Mr. Duff is Works Manager. About 135 lineal ft. of this substructure was laid in November, 1902, on a branch track leading from the Pittsburg, Fort Wayne & Chicago to the Leetsdale Works of the Riter-Conley Company. This track gave satisfactory service until April, 1903, when it was removed for a test in street railroad track. It was then placed on the Forbes street line of the Pittsburg Railway Company, and has remained there for six months in perfect condition without any repairs, although subjected to continuous and heavy traffic.

## Gravity Yards and Gravity Cars.

BY JOHN M. GOODWIN.

The problem of augmenting the capacity of the seaboard freight terminals, especially where large quantities of coal are handled, without increasing the present area occupied, has recently been very comprehensively discussed and I have followed with interest the discussion of Mr. Bardo's paper read at the last December meeting of the New York Railroad Club, recommending the general adoption of the hump gravity switching yard as one of the solutions of the problem. The several years' tests of such yards demonstrate that it is possible to handle a great many more cars in less time and with fewer locomotives, with much less cost, than with either of the old methods of poling or pushing and pulling. The economy is produced by so constructing the yard that the power of gravity may be utilized to handle the cars. The poling method shows a great saving over the pushing and pulling method, although it necessitates the additional service of the poling car with each switch engine to start each car or lot of cars down the ladder track.

In the old form of yard the locomotive was necessary to overcome the inertia, and to keep the equipment moving after the inertia had been overcome. If gravity can be utilized with such satisfactory results in the placing of cars in the hump yard, why is it not well to still further economize by using gravity unloading cars and also by unloading the gravity discharging cars into gravity discharging bins and empty these bins by gravity into barges or vessels? This natural force exists without limitation and, unlike the mechanical forces employed, it is not in the least diminished by being drawn upon to the utmost for the requirements planned in the design. Unlike any mechanical forces employed in the present systems of freight handling in terminal yards, it costs comparatively nothing beyond the wear and tear on the equipment. Therefore it remains for those desiring to avail themselves of this latent potential energy, to so arrange the conditions that this energy may be utilized.

In the coal-handling terminal yards this can be done without increasing the area of the terminal yards or dockage. Not only is the movement of the cars facilitated, but the discharge of the material from the cars to the bins and from the bins to the vessels facilitates the return of the empty cars, and lessens the number of cars held in the yard at any one time. Without increasing the yard space the output can be greatly increased, each car is able to make more round trips in the year and the cost of handling is reduced.

The arrangement of seaboard terminals, particularly where coal is handled, is an interesting problem and it is self-evident that the use of gravity in handling the freight car through the hump yard is only the genesis of the new method and the inception of the possible service to be obtained from this unlimited force. Immediately following the perfection of the gravity yard, as described by Mr. Bardo, with a view to effecting these further economies, we perfected a gravity discharging car, especially adapted to the handling of coal. This car has undergone a series of improvements until something like perfection is got in the present Goodwin car.

The gravity discharging storage bins operate in conjunction with these gravity discharging coal cars. The single deck chute will meet most of the requirements of the coal service generally found at the seaboard terminals. The double-deck and three-bin trestle construction is designed for special requirements and has several advantages under the conditions it was designed to meet. It is hoped that there will be found in the suggestions here given at least a nucleus worthy of consideration.

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## EDITORIAL ANNOUNCEMENTS.

*CONTRIBUTIONS.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

*ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

It may be well to say frankly that the lack of definite information got from many years of random experiments in tie-treating is disgraceful. Not an engineer in this country is yet satisfied, either that his avoidance of use of treated ties is justifiable, or that the treated ties he is using are so treated by even approximately the best process. The experiment begun in February, 1902, near Beaumont, Texas, was indeed promising, for in that peculiar climate the results of a 2 years' trial are as instructive as 10 years in a northern climate. But it now appears that some of the specimen ties there used were so imperfectly treated that the results, when reported, may be unfair; and, worse than this, the results, such as they are, are for the present buried, and we may have to begin all over again. It is not necessary to try to place the blame; it is rather for us to have from the Bureau of Forestry an exact statement of what has happened at Beaumont to each untreated tie of the kinds of wood tried, and to each of the ties preserved by different processes, both perfectly and imperfectly treated. This should add something to present information and indicate what else is needed. No unsolved problem is more certain of solution than the development of a preservative process at a cost of something like 10 cents a tie, in place of the present prohibitive costs; and a means of holding the rail to a cheap, preserved, soft-wood tie at a moderate cost. Loblolly pine, beech, black spruce, cypress, the sap wood of yellow pine and other cheap materials are waiting for that use. The black spruce forests north of the St. Lawrence river are not fully explored, but enough of it has been cruised to show that its supply cannot soon be exhausted. The Canadian ad valorem duty is about 4 cents a tie, and the chief cost is cutting and transportation. Eastern and central western roads can now get ties of black spruce, beech, cypress, sap-wood yellow pine and probably other available timber at something like 50 cents each, and with cheap and effective treatment, two blades of grass will grow where one grew before.

Of the long-leaf yellow pine ties, from south of North Carolina about 5,000,000 yearly come to Baltimore, Philadelphia and New York, and it may be worth while to consider the waste caused by the specifications. One standard form contains the following:

> The faces shall be parallel and free from deep score marks, splinter and other inequalities of surface. They must be well hewed on four sides, with ends sawed square. No sap will be allowed except one inch on the corners, measured on the face. This refers to the poorest tie. The majority shall show less sap. The variation in thickness shall not be more than ½ in., and the variation in length not more than 1 in. in 8 ft. . . . Sawed ties will be accepted only under special agreement.

Under these specifications, accepting only straight thoroughly sound timber, a life of about nine years is got under good conditions, but at what cost and with what ultimate results? In order to comply with the sap rule in the specification, the top of each tree is left to rot in the woods. The demand that ties be hewed instead of sawed causes the destruction of a lot of sound, straight, pine lumber. The amount of waste caused by these two rules is not capable of exact statement, but estimates made by large contractors for yellow pine are precise enough for the present consideration. One of these, who has made a special examination of his timber lands in order to know how many sap ties were left in the trees which he cuts for heart ties, believes that he could get an added 6 in. x 8 in. sap tie for every four 7 in. x 8 in. heart ties. That is to say, something like 20 per cent. of the lumber is lost from this cause. The loss due to hewing instead of sawing is not so easy to ascertain. It varies with the size of each tree—from a small amount, in a 1-tie log, to 50 per cent. in some larger logs split and hewed. The lumbermen's estimates of the average loss, due to hewing, vary and in different localities there is an actual variation; but it is safe to say that the use of the axe, the wedge and the broad axe leaves on the ground one-fifth of the valuable wood in the form of slabs and chips to feed forest fires, and that this proportion of the whole would be saved if the logs were taken to mill and economically sawed for ties and lumber. The lumbermen say that they could and would do this, at a profit to themselves, and for the good of the community in postponing the evil day when yellow pine will be almost extinct, if the specifications did not usually demand hewed ties.

It appears, therefore, that considerably more than 100,000,000 ft. b. m. of valuable lumber are yearly wasted in this one yellow-pine region. It is not uncommon for trackmen to guess that a hewed pine tie lasts a year longer than a sawed one, but this is not proved by known systematic records. From the nature of the case such records are not obtainable, for on all progressive roads the drainage, the quality of the ballast, the spiking and the protection from cutting by the base of the rail have been continually improved, and, due to these better methods, the life of the ties has been prolonged. On the other hand, higher speed and heavier loads have caused more cutting, re-spiking and breaking and have shortened the average life. It is really an open question, a matter of doubt, whether the swifter decay of a sawed pine tie is not so slight as to be a negligible quantity. They all have one element of danger; they rot most from the under side, and this weakening is not discovered in ordinary inspection, although it is quickly found by tapping the tie with a hammer or pick. It is a bad fault. Of course it is not economical to put sap-wood pine ties in the track unless they have a preservative treatment, but for such treatment they are attractive because they are easily permeated and because they are not costly at Atlantic ports, where they can be delivered, usually, for less than 50 cents.

Protection of banks from sliding, especially in cuts, has not been systematically studied and developed in this country at all comparable with the results obtained in England. We make slopes of 1½ to 1, or better, in earth work, taking into consideration the general average of the material cut through. The original work on most roads in this country did not go much beyond this. Ditching along the right-of-way near the top of the banks to keep the surface water off; scratching down the bank as water loosens material and makes it dangerous; keeping the ditches open on each side of the track; and heavy repair work where slides happen because water has lodged in clay pockets and other dangerous spots; all this has been the continuous work of the track forces for years after the road is in operation. In England it has always been the practice to investigate the quality of earth in a bank as soon as the cut is made, and put in pillar drains, shallow ditches filled with broken stone, wherever there is a likelihood of shifting and sliding. When the bank has been so protected from the action of water, its face is made permanent by a coating of soil and sowing grass seed in it. The methods of doing this work, described on another page by Mr. Cudworth, of the North Eastern Railway, are interesting and instructive.

The experience of recent years indicates that a higher coefficient should be used for the compensation of curves, than has heretofore been considered good practice. The operating department complains frequently of "sticking points," where the grades are light and the curves are moderate, giving a resultant grade less than the prevailing maximum grade on the division. These points are usually at division yards, water tanks, sidings, etc., where freight trains are liable to be held. These complaints indicate that the present equating of curves does not allow trains to start easily from rest, although the curves may be all right for running. Dynamometer tests have shown that the train resistance per ton may be more than twice as great at starting as it is after a speed of 20 or 30 miles an hour is attained. Furthermore, the almost universal use of tonnage rating systems for loading freight engines has had a tendency to load trains up to their absolute maximum for the ruling gradients. The effect of this is to reduce the reserve power of the locomotive at the head of the train and hence increase the liability of stalling. The increased density of traffic and the use of block signals causes more stops or slow downs now than formerly, which makes it necessary to equate curves for starting conditions and not alone for running conditions. A great many coefficients have been suggested, but the plan adopted by one Eastern road seems to be good. It is as follows:

| | Per cent. | | Per cent. |
|---|---|---|---|
| 1 degree curve | .03 | 6 degree curve | .26 |
| 2 " | .07 | 7 " | .32 |
| 3 " | .11 | 8 " | .38 |
| 4 " | .15 | 9 " | .44 |
| 5 " | .20 | 10 " | .50 |

For higher degree curves the rate increases more rapidly. For new main line locations with maximum grades of 15 to 21 feet per mile and with curves not over 5 degrees, a fixed rate of .04 per cent. per degree is used, which gives for the majority of the curves, which are from 1 to 3 degrees, a slightly higher rate than that given above. For example: 1 degree curve, .04 per cent.; 2 degrees, .08 per cent.; 3 degrees, .12 per cent.; 4 degrees, .16 per cent.; 5 degrees, .20 per cent. If the conditions permit it is better to equate curves too much rather than too little, especially if a main line is to be changed. On the other hand, if the location concerns some new branch line, having comparatively light traffic, with less liability of trains being stopped, a lower coefficient for compensation can be used, except at reverse curves and at curves so close together as to allow one train to cover more than one curve; or on long curves on a long ascending grade where the effect of momentum would be lost. Passing sidings and division yards should always be heavily compensated. It is rather difficult to adopt a fixed rule covering all roads and all conditions of traffic, but a careful study will in most cases show that higher coefficients can be used to advantage.

### Looking Toward Railroad Electrification.

The purchase by the New York, New Haven & Hartford Railroad Company of the trolley system of the city of New Haven and outlying towns, has two leading aspects—one physical and local, the other general and suggestive of the future rather than the present. The physical and local fact is one of impressive magnitude in the electric policy and annals of steam railroads. By the purchase the New Haven company acquires the most valuable street railway system in Connecticut and one of the largest in New England. The 110 miles of single trackage of the acquired company added to the trackage of other Connecticut trolleys bought up by the New Haven company gives 187 miles in the State, or about 32 per cent. of the whole Connecticut trolley trackage. If to that is added electric trackage owned or controlled in Massachusetts and Rhode Island, the total held by the steam company rises considerably above 300 miles. Fiscally it is somewhat difficult to compute in terms of capitalization the size of the purchase owing to the glaring defects of the Connecticut Railroad Commission reports. But, on the basis of gross earnings, the Fair Haven & Westville system (of New Haven) last year brought in about one-quarter of the gross earnings of all Connecticut trolleys; and the steam corporation's gross earnings from street railways of Connecticut for the coming year will represent about 31 per cent. of all the gross earnings of those lines in the State. A point of somewhat specialized interest is the fact that the Fair Haven & Westville parallels for about 40 main line miles the tracks of the purchasing corporation.

As an index—and the first one—of the policy of President Mellen in dealing with electric competition the new purchase is significant. It does not, to be sure, touch very closely his problem of local and short distance rivalry, though one phase of that will be referred to later. It does not forecast his plans with reference to his electrified or steam lines, or to the retention of unprofitable trolleys. But it does betoken what may be called a positive and definite "long distance" policy of blocking extended parallels of his corporation's main stem between New York and Boston. This is not original with him. Under President C. P. Clark the policy was adopted in a limited fashion by the purchase of the Stamford and Meriden street railway systems. But now President

Mellen takes up the policy of Mr. Clark, and vastly amplifies it. He is prompted, no doubt, immediately by the threatened electric parallels via Worcester, Rockville, Conn., and Hartford to New Haven, of which two links are already built and two projected. There is nothing, it is true, to prevent absolutely such an extensive line from "looping" a city like New Haven in its advance toward New York City. But the physical obstacle is considerable, a cross country line is bare of local business, and the tapping of important cities is vital to its success as both an immediate and remote competition.

There are other questions which such a large purchase by a steam railroad corporation raises. For example—and exactly such cases exist in the particular merger—what is the policy of a steam company as the owner of both the steam and trolley competitors? Will the steam or the electric rivalry give way? The answer in terms of corporative common sense as well as of public interest is ready at hand. The electric traffic must be favored and the steam service reduced, the loss by the latter being of relatively small import so long as the receipts of both go to the same corporative pocket. To a second query the answer is more obscure. In the wholesale purchase of urban systems to block long distance parallels, what will be the policy of legislatures toward long distance lines with reference to the right of urban entry—either independently or over the purchased system under control of hostile interests? Hitherto, in general, the entrance of outside lines on unified urban street railway systems has had to be obtained by special contract and concessions, and even when there are general railroad statutes on the subject they are apt to be evaded in spirit and practice by the urban monopoly, whether steam or electric. Will such a policy give us a new and more drastic direction of law-making on interchanges of electric traffic? That it will at least promote some acute legislative controversy seems pretty certain.

In more general phases still the New Haven precedent has large meanings. Experience has shown clearly at the west that direct interurban competition by the old steam companies with electric lines has been futile. But here is a new proposition: For competition by operation has been substituted the new method of competition by purchase, using the word "competition" here in its broadest sense to include prospective rivalry. The method, should it ever become generally accepted, introduces us to an entirely new set of theorems bearing on the relations of steam and trolley. Beyond lie even larger potentialities, such as bringing nearer the period when, with the great steam railroads operated with electric locomotives, and owning large urban street railway systems, the electric car, for purposes of local traffic, may duplicate service on the city street and the electrified steam line. It is not very remote, and the Fair Haven & Westville sale is one of the striking events that nods towards it.

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The Philadelphia & Reading, which for some time has run extra freight trains on its New York Division without written orders, has extended this plan over the Reading Division. As has been the practice, substantially, on the New York Central, the Pennsylvania and certain other roads for a number of years, freight trains are started from terminals on the order of the assistant trainmaster without the formality of an order on form 31 or form 19; and from side tracks at intermediate stations by a semaphore signal indication, without any written order whatever, the signal indication being given by the signalman on an informal order from the train despatcher. The order of the Reading says that if a passenger train is due, the men in charge of a freight must not accept a signal to proceed on the main track unless they know that their train is in condition to make good time; and while thus on the main track they must not do any work without permission from the despatcher. If, while thus running immediately ahead of a passenger train, a freight train is unable to make good time, the engineman must enter the first available side track. According to a Philadelphia paper, Mr. Beach, Superintendent of the New York Division, says that it is his ambition to run trains in this manner, not only with the current of traffic, but also in the opposite direction, where necessary. According to the Cleveland *Plain-Dealer* the abolition of train orders, as indicated in the foregoing lines, has been ordered on the Lake Shore & Michigan Southern. All freight trains will hereafter be identified by the numbers of their engines instead of by a separate train number.

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The number of passengers killed in the butting collision near Willard, Kan., on January 6, at one o'clock in the morning, was 17, and of injured, 21; and 6 employees were killed. The account of this accident in our monthly record (published Feb. 26, p. 145) was indefinite as regards the number of casualties, authentic information having been delayed in reaching us. The cause of the accident was originally said (as on the authority of an officer of the road) to be the failure of the men in charge of the passenger train (No. 3) to identify a freight train standing on a side track. The explanation given by the engineman, as now reported, puts a somewhat different face on the matter. The orders which had been given to the passenger train were as below:

"C. & E. No. 3 and No. 13:—Extra 1417 East will meet No. 13 and No. 3, engines unknown, at Willard."

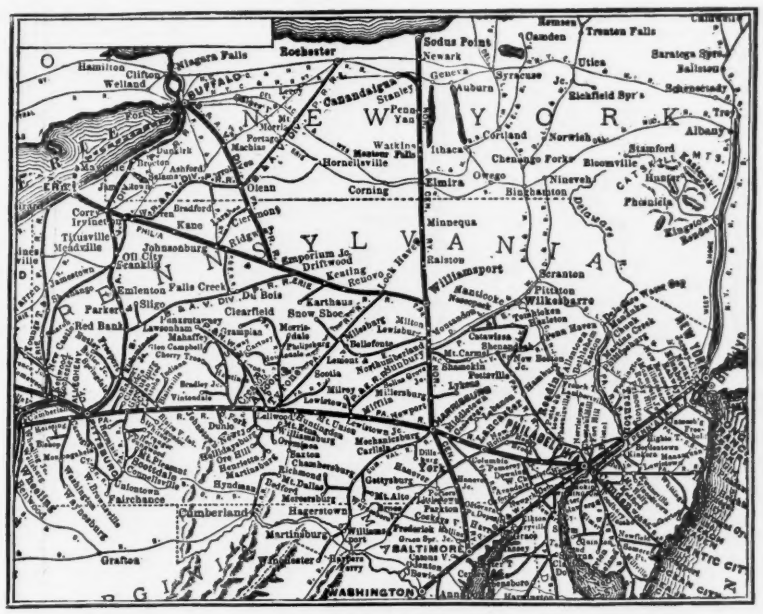
"C. & E. No. 3 and No. 13, Extra 489 East and all concerned:—No. 3 and No. 13, engines unknown, will wait at Valencia until 12:55 a. m., for Extra 489 East. No. 3, engine unknown, will run 30 minutes late Topeka to Herington."

The engineman claims to have mixed the orders in his mind, assuming that they read "Train No. 3 will wait for Extra 1417 East at Valencia," and "Train No. 3 will meet Extra 489 at Willard." The reason why the conductor did not stop the train when he found that the engineman was not reducing speed at the proper point remains unexplained. Apparently this adds one more to the long list of cases wherein the conductor leaves the question of stopping at meeting points wholly to the engineman.

## Pennsylvania.

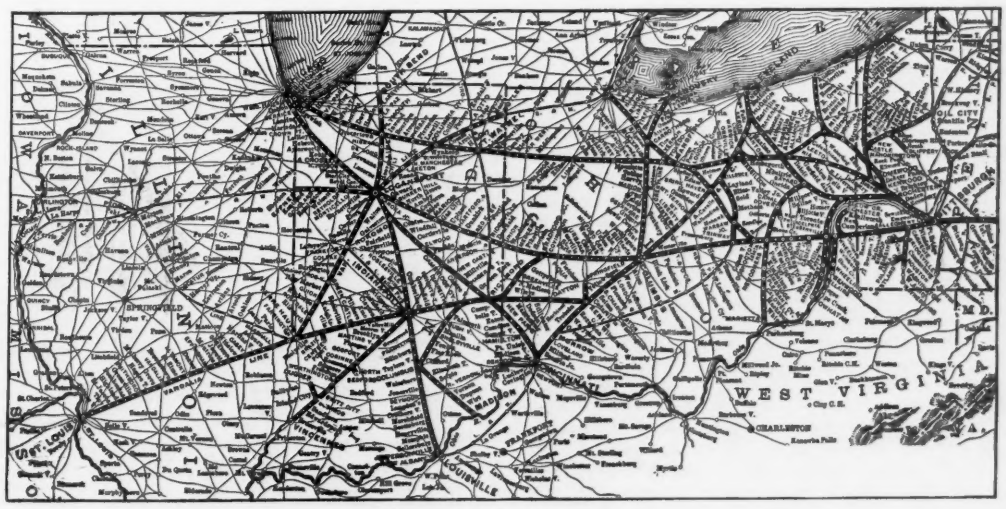
It would be interesting for many reasons if the annual report of the Pennsylvania should cover the year ending June 30 in order that more exact comparisons might be made with other railroads. Coming at the present time, however, and including in its returns the calendar year ending December 31, the Pennsylvania report deals not only with the continued great prosperity of the first months of 1903, but also with the depression of the last months, which resulted chiefly in a diminishing of the gains in gross earnings, while operating expenses went on unchecked. The gross earnings of the entire system, including all lines both east and west of Pittsburg and Erie owned, operated or controlled by, or directly affiliated in interest with the Pennsylvania, were $242,517,758 on 10,914 miles worked. The increase over 1902 amounted to the startling sum of $22,438,528 on an increase of 130 miles of line worked. A financial writer has made the apt comment that these figures sound more like the revenue of a kingdom that the gross earnings of a railroad. In spite of this tremendous increase in earnings, however, averaging for the entire system $22,220 a mile, as against $20,407 last year, operating expenses increased yet more rapidly, and in 1903 were $175,379,438, as against $152,539,719 in 1902, the increase of $22,438,528 in gross earnings comparing with an increase of $22,839,719 in operating expenses. After reckoning in other income, however, the balance swings again to profit increases, and the gross income of the entire system is shown to have been $85,933,657, as against less than $84,000,000 last year. The ultimate surplus, after interest, rentals and dividends and other charges, including extraordinary expenses were deducted, amounted to $3,067,247 from the year's operations, an increase of $173,396.

The above figures giving the aggregate working results of the entire system are open to the criticism from the standpoint of the reviewer that they include such diversity of territory and of operating conditions that they are of almost no value as a lesson in railroading, except so far as they show what magnificent results can be obtained by a successful harmonization of the interests of 11,000 miles of railroad traversing the most profitable traffic territory in the country. The report is really a collection of some 12 annual statements, varying in importance from the Pennsylvania Railroad Company proper, with gross earnings of 122½ millions, to the Cumberland Valley Railroad, with gross earnings of two millions. Taking the general division of lines east and lines west it will be seen that earnings increased faster than operating expenses on the lines east, while the reverse was true on the lines west, although the Pittsburg, Cincinnati, Chicago & St. Louis showed a small gain in net. The division which makes the best relative showing is the Philadelphia & Erie, with an increase of $741,999 in net from operation, while the net earnings on the Union Railroads of New Jersey, including the Delaware & Raritan Canal, make the worst showing, with a decrease of $696,120.




Pennsylvania Lines East.

The tremendous improvement work of the last few years, which has been described as an attempt to do in a few years the work of a generation, has been prosecuted vigorously in spite of the sinister increase in operating expenses. The work has involved building and completing new lines and branches, extension of the four-track system, establishment of additional freight yards and further revision and improvement of the grades of the existing lines, besides which a large amount of additional motive power and equipment has been acquired. The pressing necessity for these expenditures was shown by the operations last year, for while there was an improvement in the movement of traffic compared with 1902, it was far from satisfactory. The company had too much business, as it has been having too much business for several years, and the provisions for getting the increased traffic out of the way seem to have been absorbed almost as fast as they were completed. Comment is made that the condition most favorable to economical movement of traffic existed in 1899, when, although the volume of business upon the line between New York and Pennsylvania was larger than in any preceding year, and 19 per cent. in excess of that of 1898, the facilities were fully employed and not at that time overtaxed. As a result, the ton-mile cost that year was the lowest in the experience of the company, less than 3½ mills. But with the continued increase in tonnage since 1899 there has been constant evidence that largely increased facilities must absolutely be provided, and provided at once, the congestion causing not only undue expense in handling freight, but also a diversion of a large amount of tonnage to other lines. In 1899 the freight business of the Pennsylvania Railroad Division amounted to 8 billion ton-miles, comparing with 6¾ billions in 1898 and 6¼ billions in 1897, and as stated, filling the lines to their maximum capacity for economical handling. But in 1903 this ton mileage had increased to a figure well in




Pennsylvania Lines West.

excess of 10 billions; freight earnings per mile of road were $31,964 in 1903, as against $19,039 in 1899, and freight expenses per mile of road amounted last year to $21,457, as against $13,572 in 1899. The increase of tonnage on this division alone was 31 per cent. during the four years, and while cars and locomotives can generally be procured with reasonable promptness, considerable time is required to complete tracks, yards, shops and other terminal facilities. Until these can be provided the large increase in ton-mile cost, which for 1903 was 25 per cent. greater than for 1899, cannot well be avoided.

The general scheme of the improvement work has been fully described in the *Railroad Gazette*, and is designed, roughly speaking, with the two main ends in view of providing more lines, and lower grade lines, between Pittsburg and tide water. In connection with this it has been necessary to greatly increase the capacity of a number of yards, while the actual construction work has been equivalent to the out-and-out building of several new and high-class railroads in the territory traversed. The best idea of what is being done is conveyed by the statement that the aggregate expenditures during the year upon the line between New York and Pittsburg and the branches operated in connection with it, amounted to $44,006,386, which includes $11,830,781 for equipment and shop tools and machinery, and $4,385,717 for right of way and real estate. Expenditures of this character place the Pennsylvania entirely out of the class of other railroads in the country, and they must be viewed as a part of an extraordinary system subject to extraordinary expenditures, but profiting by enormous traffic receipts.

The income for the year was sufficient, after the payment of all charges and dividends, so that $9,472,728 could be charged against it towards this 44 millions of expenditure. Of the remainder of the cost, 22,171,108 was charged to capital account and $12,362,551 against the premium realized upon the issue of new capital stock. Out of the residue of this premium, $5,000,000 was appropriated towards the cost of the real estate purchased for the terminal station in New York and the balance was applied in the reduction of the value of securities and outstanding accounts. Expenditures upon branch and auxiliary lines to this main part of the system also aggregated $6,897,188, not included in the above, and were met by the several companies out of their own resources. The largest branch line outlay occurred on the roads specially engaged in the bituminous coal and coke traffic, notably upon the Pittsburg, Virginia & Charleston, where the exceptional development of mines and manufacturing industries of the Monongahela Valley required the most liberal expenditure to take care of the traffic. Besides the connection with these industries which the line affords, it also enables through traffic to be exchanged with the northwestern and southwestern portions of the Pennsylvania system through the Port Perry branch without passing through the congested Pittsburg district. The Pennsylvania already owned over 90 per cent. of the Pittsburg, Virginia & Charleston capital stock, and it was therefore deemed advisable to acquire the small amount outstanding, and in order to provide for necessary capital expenditures the stock was increased to $6,000,000 and the funded debt to an equal amount of 40-year 4 per cent. bonds, with principal and interest guaranteed by the Pennsylvania.

The same conditions which necessitated heavy expenditures on the main line also affected the companies west of Pittsburg, as well as the Northern Central, Philadelphia, Baltimore & Washington and Long Island companies. Large advances were made by the Pennsylvania to these roads.

The total charges of capital account during 1903 aggregated $29,291,910 of which 16½ millions were for extraordinary expenditure in connection with the Pittsburg tide water betterments, yards and shops, etc. Seven millions represent the additional cost of six allied railroads absorbed; 3½ millions were spent for equipment, principally locomotives; and two millions for real estate. The total increase in capital stock amounted to over $92,000,000, besides which there is $4,764,750 of stock not yet entirely paid in, so that the entire figures for the year amounted to approximately $97,000,000, of which the two principal items were the allotment of $70,249,550 to shareholders a year ago, and $20,911,650 issued on account of the conversion of $29,202,500 convertible 3½ per cent. bonds dated November 1, 1902. The company is thus well financed for the tremendous work at hand, of which the largest piece now remaining to be done is the New York tunnel and terminal. The report is incomplete in that it makes no statement as to the application of these funds, further than that $5,000,000 was used for real estate in connection with the New York terminal.

The total sum spent between Pittsburg and tide water since 1900 is $87,242,013—all applied, in three years time, in a territory where the Pennsylvania already possessed a well equipped system. Of the entire amount, $30,545,383 was charged directly to capital; $15,899,308 to premiums on stock sold, equivalent to capital funds secured at a low interest rate, and $40,797,323 was appropriated out of income without disturbing the regular dividends. It naturally occurs to the reader that a sum representing vast net earning power has for several years past been tied up in these extraordinary betterments, and that sooner or later, when the capacity of the lines has been brought up to the required economical standards, these surplus earnings should again be released. This can apparently be accomplished before very many years, but meantime the capital increases are making constant demands, shown on one hand in the fixed charges, and on the other, in a larger divisor for surplus profits. The New York tunnel, restricted to passenger business as it will be, is quite an unexampled exhibition of daring; it will have to earn the interest on something approximating 100 millions if it is to carry itself without aid from the rest of the system.

Speculation as to the ultimate profitableness or unprofitableness of the present Pennsylvania expenditures are quite futile, however; ten years ago, no one could have foreseen the business of the present time, which fairly caught the company unprepared, in the years following 1899. The work now being done anticipates great and increasing traffic, and the management is capitalizing its convictions with splendid courage.

Statistics of operation follow:

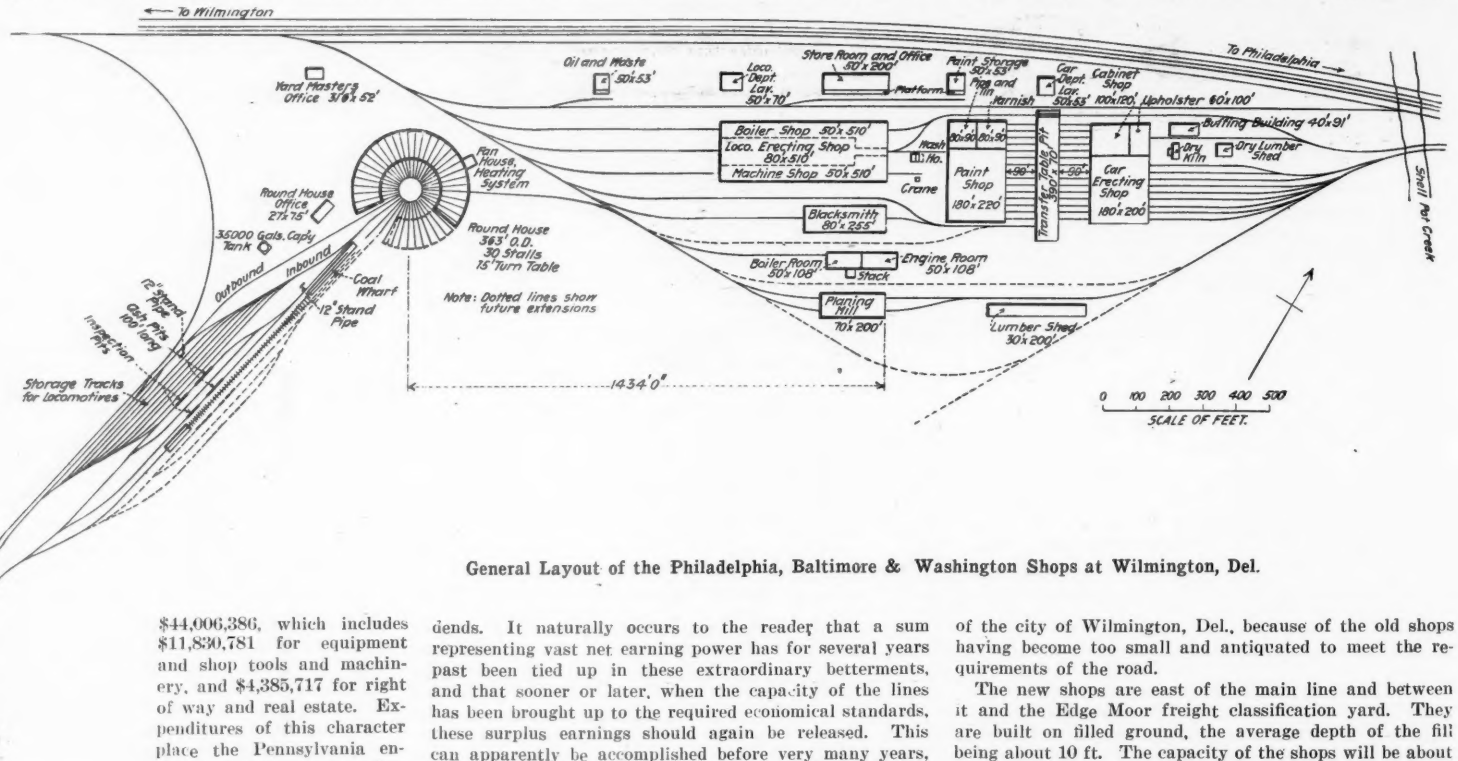
| | 1903. | 1902. |
|---|---|---|
| Gross earnings, P. R. R. Co. | $122,626,419 | $112,663,330 |
| Total earnings, lines east | 160,826,095 | 145,649,764 |
| Gross earnings, Penna. Co. | 36,602,935 | 33,025,648 |
| Gross earnings, P. C. C. & St. L. | 28,960,821 | 26,634,357 |
| Total earnings, lines west | 81,691,662 | 74,281,552 |
| Grand total, operating earnings | 242,517,758 | 220,079,230 |
| Operating expenses, P. R. R. Co. | 84,773,056 | 75,051,071 |
| Total operating exp., lines east | 113,361,191 | 98,287,062 |
| Operating expenses, Penna. Co. | 27,116,684 | 23,308,429 |
| Operating exp., P. C. C. & St. L. | 22,278,252 | 19,960,452 |
| Total operating exp., lines west | 62,018,247 | 54,252,657 |
| Grand total, operating expenses | 175,379,438 | 152,539,719 |
| Grand total, net earnings | 67,138,320 | 67,539,511 |
| Grand total, gross income | 85,933,656 | 83,794,222 |

## New Shops of the P., B. & W. at Wilmington.

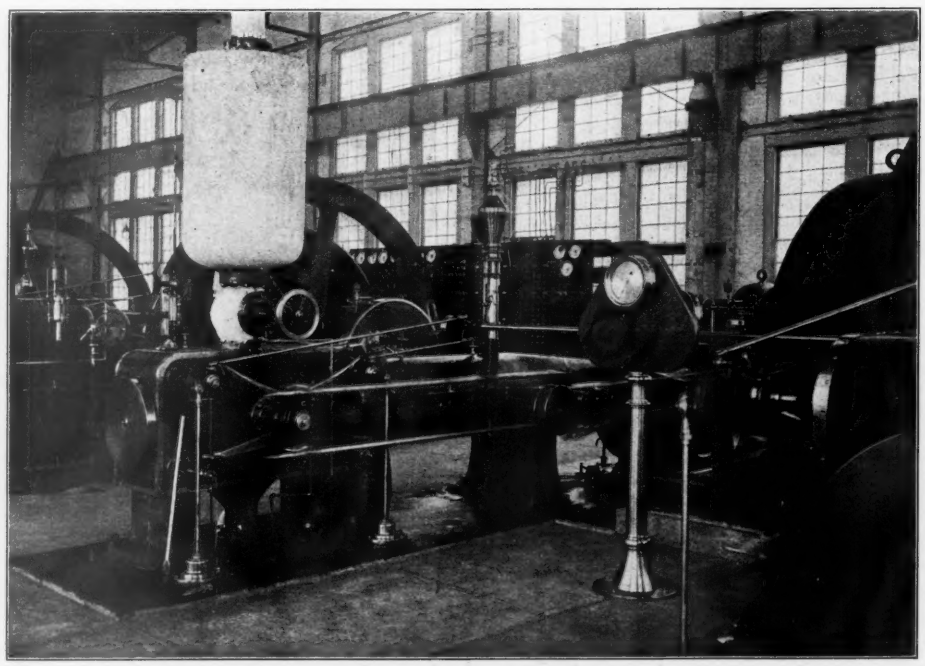
The Philadelphia, Baltimore & Washington R. R. Company has recently completely some new locomotive and passenger car repair shops, which are located just north of the city of Wilmington, Del., because of the old shops having become too small and antiquated to meet the requirements of the road.

The new shops are east of the main line and between it and the Edge Moor freight classification yard. They are built on filled ground, the average depth of the fill being about 10 ft. The capacity of the shops will be about 35 locomotives and 75 passenger cars per month, the freight car repair yard being located alongside of the Edge Moor classification yard.

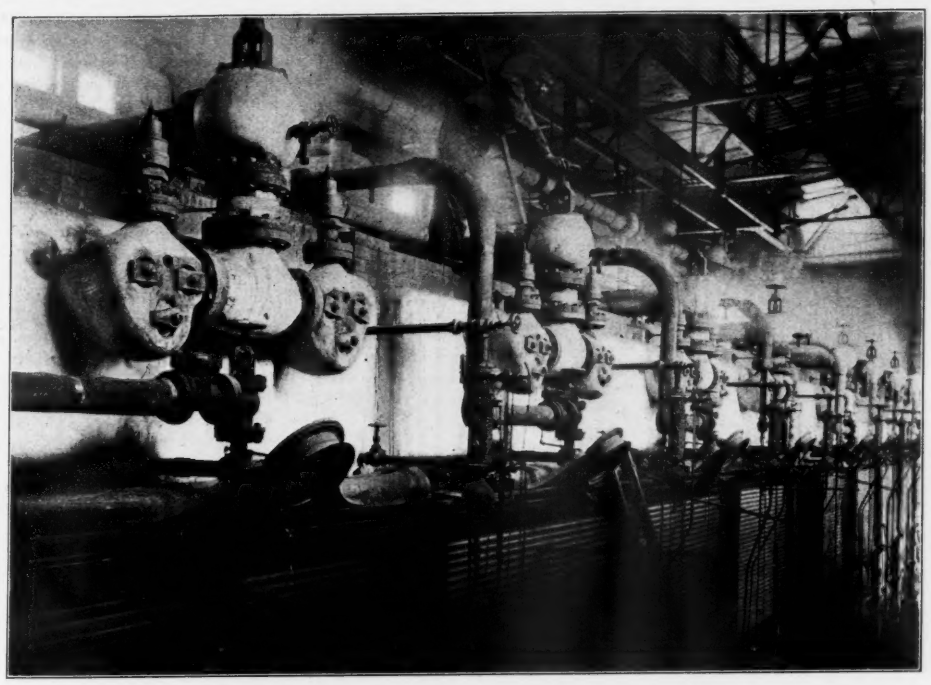
The principal buildings include the main locomotive shop, 180 ft. x 510 ft. This is a 3-bay building, the center bay is 80 ft. wide and contains three longitudinal tracks for repairs to locomotives. A 50-ft. bay on the east side is used as a machine shop and a 50-ft. bay on the west side is used as a boiler and flue shop. There is also a blacksmith shop, 80 ft. x 260 ft.; a planing mill, 70 ft. x 200 ft.; a power house, 50 ft. x 216 ft.; a paint shop, 180 ft. x 300 ft., containing in the west end a var-




General Layout of the Philadelphia, Baltimore & Washington Shops at Wilmington, Del.



Engine Room—P. B. & W. Shops.



**Steam Piping in Boiler Room at the P. B. & W. Shops.**

nish room, 90 ft. x 80 ft., and a pipe and tin shop, 90 ft. x 80 ft.; a car-erecting shop, 180 ft. x 300 ft., containing in the west end a cabinet shop, 100 ft. x 120 ft., and an upholstery room, 100 ft. x 60 ft. The roundhouse is 363 ft. in diameter and will eventually contain 44 stalls, of which 30 stalls have been completed. The roundhouse is provided with two inspection pits, two ashpits and a coaling trestle provided with pockets which dump directly into the locomotive tenders. The inspection pits are ahead of the ashpits, so that inspection can be made to determine the necessity of drawing fires, etc., before the engines go into the house. The roundhouse is also provided with an electrically-driven turntable 75 ft. in diameter.

The smaller buildings comprise a two-story storeroom and office building, an oil house, a paint oil storage house, a buffing room, two lavatory buildings, an office and storeroom at the roundhouse, a dry lumber kiln and a dry lumber shed. The larger buildings are brick and steel construction and the smaller buildings are brick with wooden roof trusses.

The lighting of the shops is a feature, special attention having been given to this. All of the main shops are heated by the induced hot-air system, the roundhouse having a duct below the surface of the ground around the inner circle, with outlets into each pit. Each of the other buildings have the overhead system of galvanized iron piping with down-take pipes reaching to within about 12 ft. of the ground. This system has been installed by the Wm. Bayley & Sons Company, of Milwaukee, Wis.

The power house contains eight 250-h. p. Edge Moor water-tube boilers and the engine room contains three generating units driven by Hewes & Phillips cross-compound condensing engines of 300 h. p. All of the generators are the Westinghouse type, one being a direct-current 200-k.w. 250 volts, the other two being alternating, 2-phase current, 200-k.w., 220 volts. The power room also contains four Ingersoll-Sergeant compound steam, compound air-compressors, each having a capacity of 526 cu. ft. of free air per minute, compressed to 100 lbs. pressure, the compressed air being used throughout the shops and also for the operation of track signals and switches between Wilmington and Philadelphia. The power room also has a 100-k.w. synchronous motor generator which will furnish either alternating or direct current as desired. The room is also provided with two motor-driven Westinghouse motor generators to furnish current for the track signals in connection with the compressed air plant.

It will, therefore, be seen that all of the power required through the shops and for driving cranes, tools, etc., will be electrical. The direct-current generator is used in connection with the traveling cranes, there being two 65-ton traveling cranes in the locomotive erecting shop, one 15-ton traveling crane in the machine shop and one 15-ton and one 20-ton traveling crane in the boiler and flue shop.

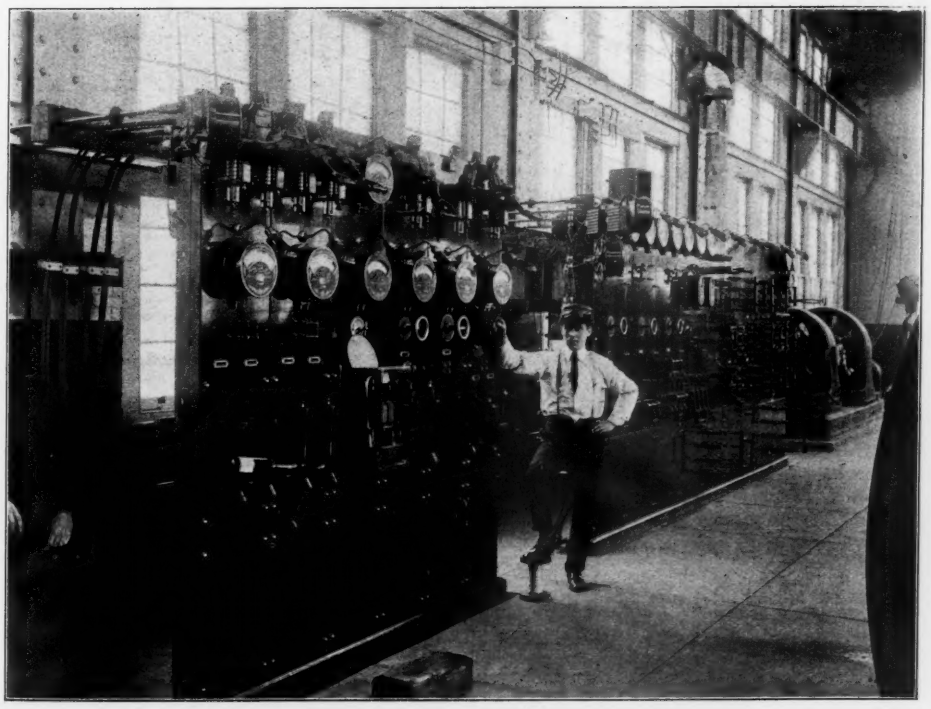
Between the car-erecting and paint shops there is a transfer pit 70 ft. x 390 ft., which is provided with a direct-current motor-driven transfer table.

All the machines which are run at constant speed or in groups are driven by 2-phase induction motors, the remainder of the machines being driven by variable-speed motors.

The same special attention has been given to the lighting of the shops at night as was given to provide ample light during the day. Nernst and incandescent lamps are used for interior lighting and series alternating arc lamps are used for the roundhouse and shop yards.

Details of the shops will be given in a later issue.

**Erecting Shop—P. B. & W. Shops**



**Main Switch Board in Engine Room—P. B. & W. Shops.**

## NEW PUBLICATIONS.

*Practical Lessons in Electricity.* Selected from the Electrical Engineering Course of American School of Correspondence at Armour Institute of Technology, Chicago. 7 in. x 10 in. bound in cloth.

This is a new and enlarged edition, the first edition having been exhausted in a short time. It consists of four of the 45 regular text books in the Electrical Engineering course of the school above mentioned, the foreword explaining that the purpose of the volume is to give the public an opportunity to judge of both the standard and the scope of the instruction offered. The first two books are by L. K. Sager, formerly Assistant Examiner, United States Patent Office. Though presenting the subjects briefly a good general idea may be obtained of the elementary laws and principles with which the beginner must first acquaint himself. The second book contains examples worked out under most of the heads. The third book is on electric wiring and is written by H. C. Cushing, Jr. It contains 68 pages and contains 12 tables, numerous diagrams and several half-tone illustrations, and gives a good working knowledge of this important practical branch of the profession. "Storage Batteries" is the title of the fourth book. It is by Prof. F. F. Crocker, who is a recognized authority on this subject. A list of examination questions an each subject is contained in the back of the book.

### Locomotive & Machine Company of Montreal Bought by American Locomotive Company.

The American Locomotive Company has bought the Locomotive & Machine Company of Montreal, Limited, for $1,500,000. Two-thirds of this will be paid in cash and $500,000 in 4 per cent. bonds. The financing of the purchase will be accomplished by the issue of $1,500,000 of 4 per cent. bonds by the American Locomotive Company. With the exception of the $500,000 above mentioned, the bonds will be held in the treasury of the American Locomotive Company, the payment of cash being made out of the surplus. The shops of the acquired company were only completed last fall and have been fully described in the *Railroad Gazette* and include a large wharf and pier. The capacity is about 300 locomotives a year.

### The Water Stations of the Chicago & Alton.

The Chicago & Alton, with 908 miles, probably has a larger number of gasoline-engine pumping plants in proportion to its mileage than any other railroad in the country. When the road came into the hands of the present management the water stations, other than those supplied from city mains, were, for the most part, equipped with the small duplex steam pumps and vertical boilers which have, for so long, represented general practice in this country; such plants, of course, requiring the services of a pumper who needed to devote a part or all of his time to a station, depending on the daily consumption. In 1899 the displacement of the steam apparatus by gasoline-engine equipment was begun, the first installation being at Sag Bridge, 21 miles from Chicago. Since that time the work of displacement has progressed gradually but steadily until at the present time, out of 48 stations on the system, 27, or approximately 60 per cent., have the new equipment.

The accompanying map shows the location of water stations on the line and those having the gasoline equipment are indicated on the drawing. It will be seen that the latter are all main-line stations: that is, they are on the Chicago-St. Louis, Bloomington-Kansas City and Springfield-Peoria lines, the aggregate mileage of which is 709. For the entire system there is one gasoline station to each 33.6 miles; but considering only those lines on which the stations are located, the relation is one to 26.3 miles.

As a number of new installations were made during the past year, figures for the total cost for a year's pumping under the conditions which exist at present must be estimated from monthly reports based on these conditions. The road furnishes us a statement comparing the month of November, 1903, with the same month in 1900, when there were only two small gasoline stations on the system. This statement shows pumpers' wages, cost of stores, repairs to buildings and machinery, total cost, gallons of water pumped and cost per thousand gallons. The statement shows a saving in 1903 of 2.3 cents per thousand gallons of water pumped. But there was pumped in November, 1903, 92,448,153 gals., against 72,068,456 gals. in November, 1900. The actual saving shown by the statement without regard to the quantity of water pumped is $527 for the month; but on the basis of the total amount of water pumped, at a saving of 2.3 cents per thousand gallons, the gain for November, 1903, would be $2,126. Estimating for a year on this basis the annual saving would exceed $25,000. It should be explained that the November report includes only 24 gasoline stations, three others having been built since that time.

There is another point that should be known in analyzing this statement. One small station, pumping less than 700,000 gals., has a charge against it for repairs to building and machinery of $544. This represents the cost of installing a second-hand gasoline equipment and otherwise improving the station, and makes the charge per thousand gallons against this particular station for November nearly 90 cents. This has an important effect on the totals, reducing the saving per thousand gallons from 2.88 cents to 2.3. Estimating with the former figure on the total amount of water pumped, the saving for November, 1903, would have been $2,662, and the annual saving at that rate nearly $32,000.

We have taken from the statement a list of the larger stations having the gasoline equipment, the figures for which illustrate the economic advantage which has resulted in each case from the change. Comparisons can be made for ten of these stations, two of the remaining three being points at which there had been no steam plant, and the other one, Bloomington, which still has steam, being included for a purpose to be explained later. In making these comparisons the Griggs and Ridgely stations are balanced against Lincoln, which was abandoned, and which these two replace.

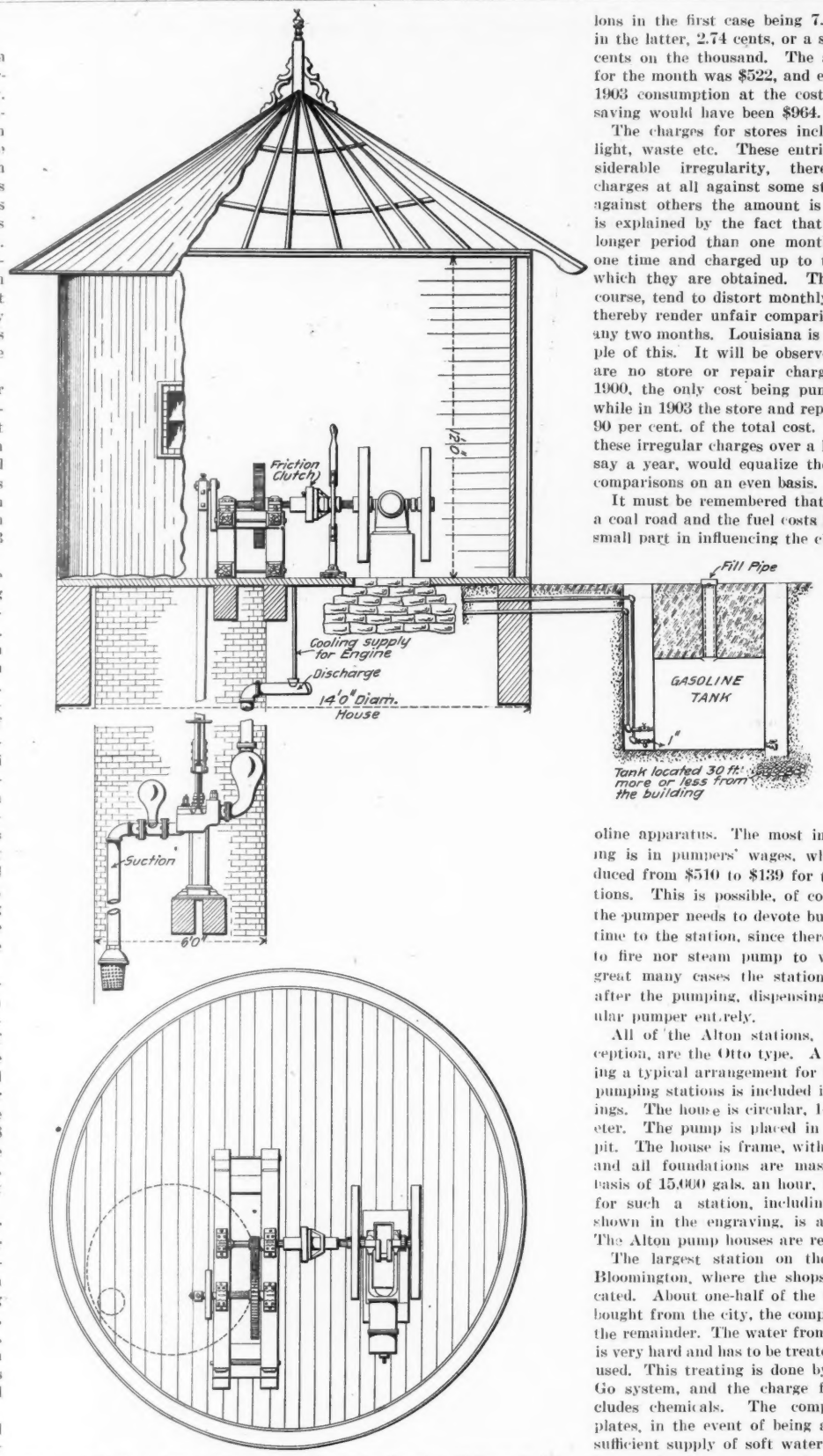
For the ten stations compared, the total water pumped was 14,258,506 gals. and 20,129,372 gals. respectively in November, 1900 and 1903, the cost per thousand gallons in the first case being 7.53 cents and in the latter, 2.74 cents, or a saving of 4.79 cents on the thousand. The actual saving for the month was $522, and estimating the 1903 consumption at the cost in 1900 the saving would have been $964.

The charges for stores include fuel, oil, light, waste etc. These entries show considerable irregularity, there being no charges at all against some stations, while against others the amount is large. This is explained by the fact that stores for a longer period than one month are got at one time and charged up to the month in which they are obtained. This would, of course, tend to distort monthly figures, and thereby render unfair comparisons between any two months. Louisiana is a good example of this. It will be observed that there are no store or repair charges at all in 1900, the only cost being pumpers' wages, while in 1903 the store and repair wages are 90 per cent. of the total cost. Distributing these irregular charges over a longer period, say a year, would equalize them and place comparisons on an even basis.

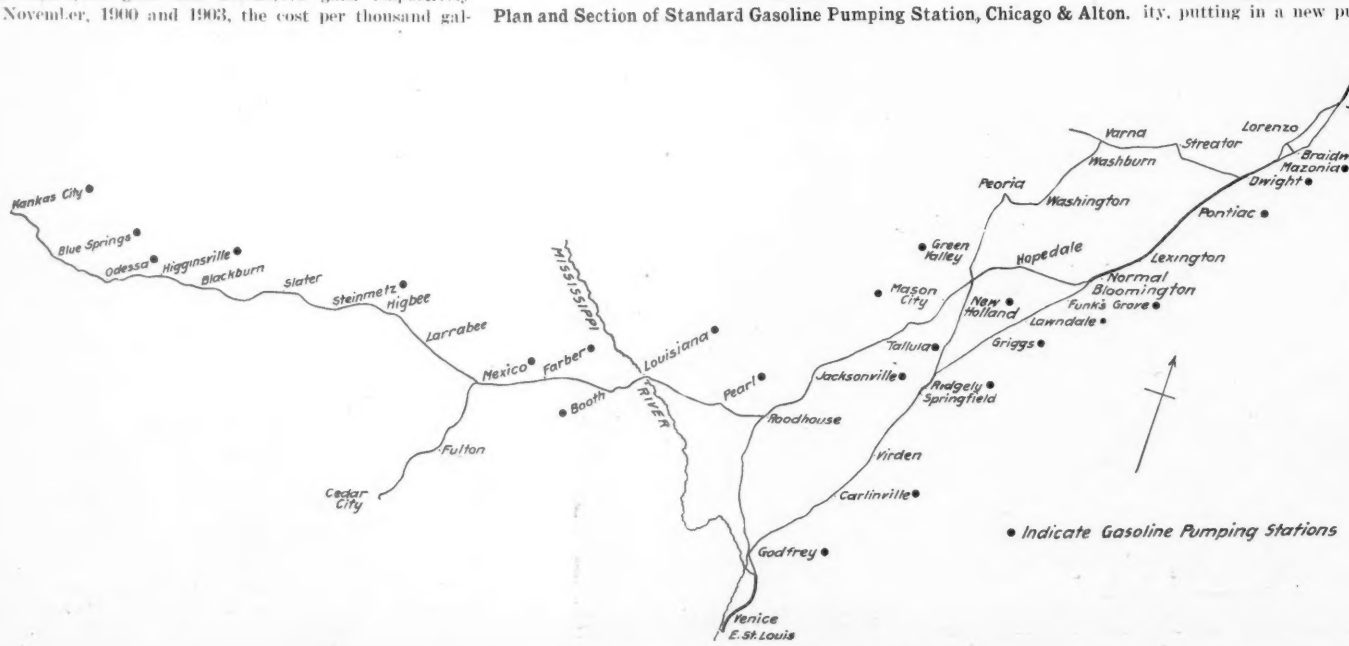
It must be remembered that the Alton is a coal road and the fuel costs therefore had small part in influencing the change to gasoline apparatus. The most important saving is in pumpers' wages, which were reduced from $510 to $139 for these ten stations. This is possible, of course, because the pumper needs to devote but little of his time to the station, since there is no boiler to fire nor steam pump to watch. In a great many cases the station agent looks after the pumping, dispensing with a regular pumper entirely.

All of the Alton stations, with one exception, are the Otto type. A sketch showing a typical arrangement for their railroad pumping stations is included in the engravings. The house is circular, 14 ft. in diameter. The pump is placed in a frost-proof pit. The house is frame, with a slate roof, and all foundations are masonry. On a basis of 15,000 gals. an hour, the total cost for such a station, including everything shown in the engraving, is about $1,600. The Alton pump houses are rectangular.

The largest station on the road is at Bloomington, where the shops are also located. About one-half of the water used is bought from the city, the company pumping the remainder. The water from both sources is very hard and has to be treated before it is used. This treating is done by the We-Fu-Go system, and the charge for stores includes chemicals. The company contemplates, in the event of being able to find a sufficient supply of soft water in the vicinity, putting in a new pumping station, and




Plan and Section of Standard Gasoline Pumping Station, Chicago & Alton.




Map of the Chicago & Alton, Showing Water Stations.

will pump all of its own water, which will relieve it of the cost of treating and also make the rate per thousand gallons for pumping much lower. It is expected that the saving will be at least 75 per cent. As the water used at Bloomington is about 13 per cent. of the total for the system, a reduction in its cost of 75 per cent. would affect materially the rate per thousand gallons for the system.

COST OF PUMPING WATER AT 13 STATIONS ON THE CHICAGO & ALTON IN NOVEMBER, 1900, AND 1903.

| | Pumper's wages. | | Stores. | | Repairs, buildings. | | Repairs, machinery. | | Total cost. | | Gals. water pumped. | | Cost per 1,000 gals. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| November. | 1900. | 1903. | 1900. | 1903. | 1900. | 1903. | 1900. | 1903. | 1900. | 1903. | 1900. | 1903. | 1900. | 1903. |
| Joliet | 90.00 | 15.00 | 8 41 | 59.30 | ... | 1.45 | 60.27 | 10.40 | 158.68 | 86.15 | 2,581,080 | 2,865,000 | .0614 | .0301 |
| Mazonia | ... | 38.00 | ... | 21.66 | ... | ... | ... | 35.45 | ... | 95.11 | ... | 3,429,668 | ... | .0277 |
| Pontiac | 145.45 | 10.00 | 39.75 | 54.02 | 5.34 | ... | 50.06 | 9.95 | 241.58 | 73.97 | 2,568,520 | 2,702,120 | .0940 | .0274 |
| Bloomington | 271.50 | 458.33 | 235.03 | 539.86 | 11.71 | 6.25 | 111.93 | 79.21 | 630 17 | 1083.65 | 8,370,000 | 11,037,000 | .0752 | .0982 |
| Lawndale | 34.50 | 15.00 | 58.00 | 21.62 | ... | ... | 34.02 | 11.75 | 126.52 | 48.37 | 615,440 | 1,800,000 | .2067 | .0269 |
| Lincoln | 90.00 | ... | 68.60 | ... | 2 44 | ... | 154.01 | ... | 315.05 | ... | 3,246,750 | ... | .0970 | ... |
| Griggs | ... | 15.00 | ... | 18.38 | ... | ... | ... | 3.80 | ... | 37.18 | ... | 1,180,000 | ... | .0315 |
| Ridgely | ... | 25.00 | ... | 11.96 | ... | ... | ... | 35.45 | ... | 72.41 | ... | 2,200,000 | ... | .0315 |
| Virden | 32.50 | 24.19 | ... | 11.98 | ... | ... | 29.90 | 8.15 | 62.40 | 44.32 | 1,485,220 | 2,237,500 | .0420 | .0198 |
| Louisiana | 50.00 | 10.00 | ... | 22.03 | ... | 48.50 | ... | 20.20 | 50.00 | 100.73 | 1,250,000 | 3,300,000 | .04 | .0305 |
| Mexico | 45 00 | 15.00 | 33.44 | 43.58 | ... | ... | 10.77 | 9 40 | 89 21 | 67.98 | 2,201,496 | 2,410,000 | .0405 | .0282 |
| Blackburn | 22.50 | 10.00 | 10.50 | ... | ... | 3.37 | ... | 6.75 | 32.00 | 20.12 | 310,000 | 1,434,752 | .1054 | .0140 |
| Odessa | ... | 25.00 | ... | 14.52 | ... | 5.52 | ... | 12.15 | ... | 57.19 | ... | 3,031,608 | ... | .0191 |

We are indebted to Mr. G. L. Moore, Engineer Maintenance of Way of the Chicago & Alton, and to Mr. T. W. Snow, Manager of the Otto Gas Engine Works, Chicago, for information and data furnished.

## Pillar Drains for Holding Banks.

BY W. J. CUDWORTH, *Engineer of Way and Works, So. Div., North Eastern Railway (England).*

The usual practice in England is to form railroad and other similar cuttings when in soft soil, with slopes of 1 vertical to 1½ horizontal, although this varies almost infinitely according to the character of the ground. The face of the slope is then covered with vegetable soil, which is sown with grass seed or laid with sods. An open ditch is made along the top of the slope, and a very short distance therefrom in cases where the surrounding land falls towards the line. A ditch, or drain, is also carried along the foot of the slope to take the drainage of the slope itself.

It sometimes happens that this is not found to be sufficient and in such case pillar drains are often provided. By this term is to be understood broken stone drains running up the face of the slope, and such drains intelligently applied give excellent results.

The causes leading to the slipping of earth slopes are varied, but all are due to the presence of water, and any efficient method of getting the water away is the proper cure. For instance, the drain at the top of the slope may not have been carried sufficiently deep to intercept all the land drains by which the fields are drained. This, of course, brings water out on the face of the slope and saturates it and makes the conditions for a slip. Or the top drain itself may not have been carefully formed with sufficient falls, in which case water may stand in it, and the surrounding soil become waterlogged, until finally the water bursts the face of the slope. Neither of the c causes ought to exist if sufficient care in original construction has been bestowed.

Then again the top soil may consist of sand, loam or other porous material resting upon clay, rock or other impermeable material. Water percolates to the rock, forming a slippery surface, and the soil above it becomes waterlogged, and the whole mass bursts out on the face. If the strata lie with the beds sloping towards the railroads, it much aggravates the difficulty. Springs, too, lead to trouble and the saturation of the bank.

If the above described conditions are present, it is well to provide drainage without waiting until the inevitable slips occur, as it is more cheaply done at once, rather than to wait until the slipped earth has to be removed in addition, and the seat of the slip found. A slip may come down suddenly and cause accident or delay to traffic, but if sufficient care be exercised in inspection, this should be very much the exception. In the vast majority of cases slips should be dealt with before they become serious.

When the necessity for pillar drainage becomes obvious, the first thing to settle is the extent, distance apart and general dimensions of the proposed drains. All these will vary according to the difficulty of the particular case. It may, however, be said generally that the spacing of the drains ranges from 15 ft. to 30 ft. from center to center according to the ground; and that the width of each drain is from 2 ft. to 3 ft., unless they be so deep that timbering is required, in which case they must be somewhat wider to admit of the timbering and to leave working space within. This is often necessary in large work. Frequent narrow drains are preferable to wider ones spaced further apart.

The most important point, however, is the depth of the trench to be filled with broken stone. In the sound part of the slope there is no need for this to be more than 1 ft. 6 in. or 2 ft. When, however, the slipped material is reached, it is essential that the seat of the slip should be found, and the trench taken down thereto, otherwise further slips are sure to occur.

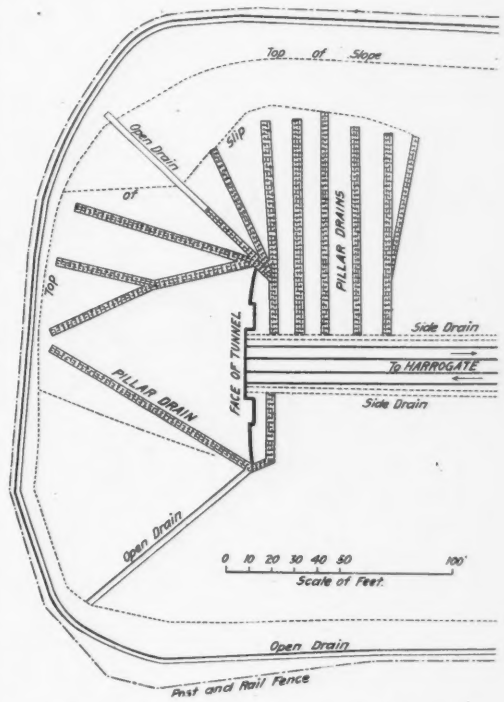
There is some divergence of opinion as to whether the bottom of the trench should be stepped or should be plain and parallel with the face of the slopes. The advocates of stepping allege that the broken stone is less liable to press or slip downwards with a stepped seat; they appear, however, to forget that the primary purpose of the drain is to get the water away; and this is undoubtedly best accomplished with a plain seat.

Another point for discussion is whether the sides of the trench should be vertical or sloped, in which latter case the drain assumes the form of a truncated wedge. The writer's experience is in favor of vertical sides.

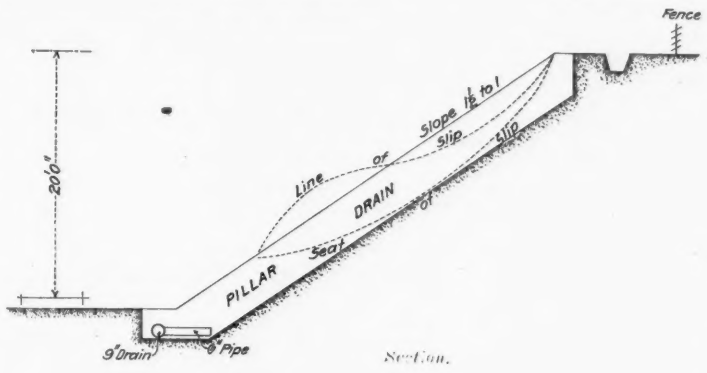
The material for filling must wholly depend on the resources of the district. Rubble, blast furnace or steelworks slag and broken brick are most commonly used. It is better that it should be fairly large and that used for forming the surface should not be greatly larger than the material beneath, but it should be "hand packed," whilst the interior material is simply thrown in.

The water discharged from the pillar drains must be taken away by the drain at the foot of the slope. It is therefore important that this drain should be of ample size, and laid with sufficient fall and frequent inspection chambers, and that the connections with it be carefully made. The method in which this is done is shown in the drawings herewith.

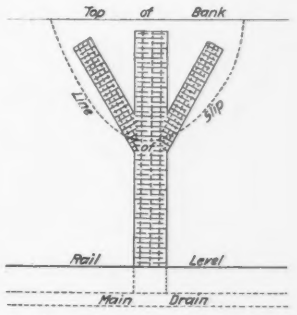
Pillar drains are occasionally made with branches, joining them diagonally. There is a great temptation to do this when the lower part of the slope is sound for a considerable distance, and there is a comparatively small amount of bad ground near the top to be drained. The danger, however, is that the water flowing down the branches naturally takes the low side of the trench, and sometimes gets into the slope itself instead of into the main drain. The only way of guarding against this risk is to make the branches at a tolerably acute angle with the main drain, say 30 deg., but unless there are special



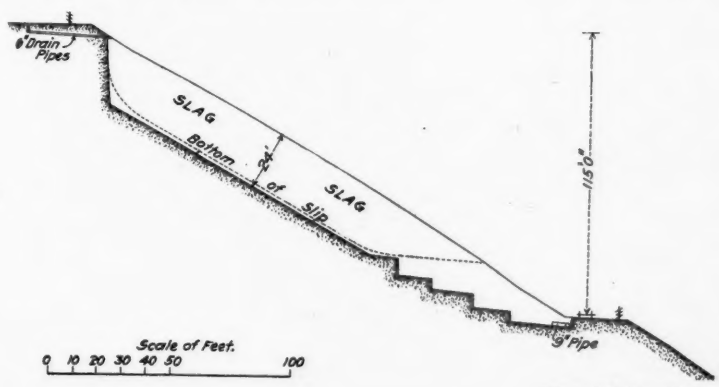

Pillar Drains at Face of Wescoe Hill Tunnel.

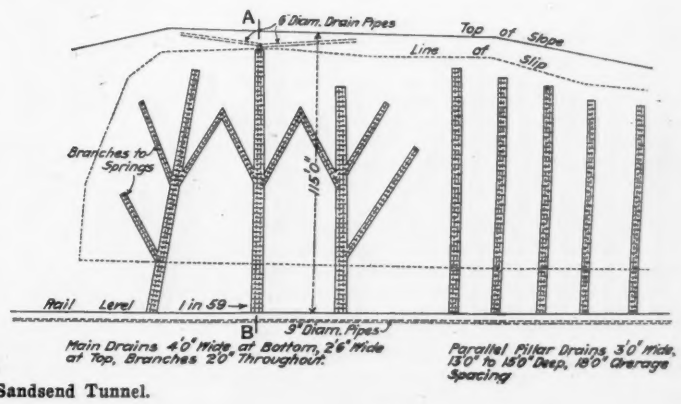



Railroad Cut, Showing Pillar Drain.




Method of Dealing With a Slip Near the Top.





A
6" Diam. Drain Pipes
Top of Slope
Line of Slip
Branches for Springs
115'0"
Rail Level
1 in 59
B
9" Diam. Pipes
Main Drains 4'0" Wide at Bottom, 2'6" Wide at Top, Branches 20" Throughout.
Parallel Pillar Drains 3'0" Wide, 13'0" to 15'0" Deep, 18'0" Average Spacing

Pillar Drains Near Sandsend Tunnel.

conditions, as above indicated, branches are better avoided.

The past autumn has been unusually wet and very trying to earthworks in Great Britain, yet the writer does not know of a single case where slopes properly provided with pillar drains have slipped, or given any trouble whatever, and they have been widely applied within his own knowledge on slopes of all sizes up to 115 ft. in vertical height.

Hitherto pillar drains in cuttings only have been described. They are also used in embankments, but to nothing like the same extent, and when so used, their aim is somewhat different, as they act both as buttresses and as drains. This being the case they are of much heavier section and not nearly so close together and usually of larger stone. In one case in the writer's experience where a sliding clay embankment on a railroad widening was giving trouble, pillar drains 10 ft. wide, 6 ft. deep and about 50 ft. apart were put in, the filling being millstone grit rubble. They proved quite effectual, and the embankment has since stood perfectly. It is, however, in cuttings that the main use of pillar drains lies.

## The Lawson Dump Car.

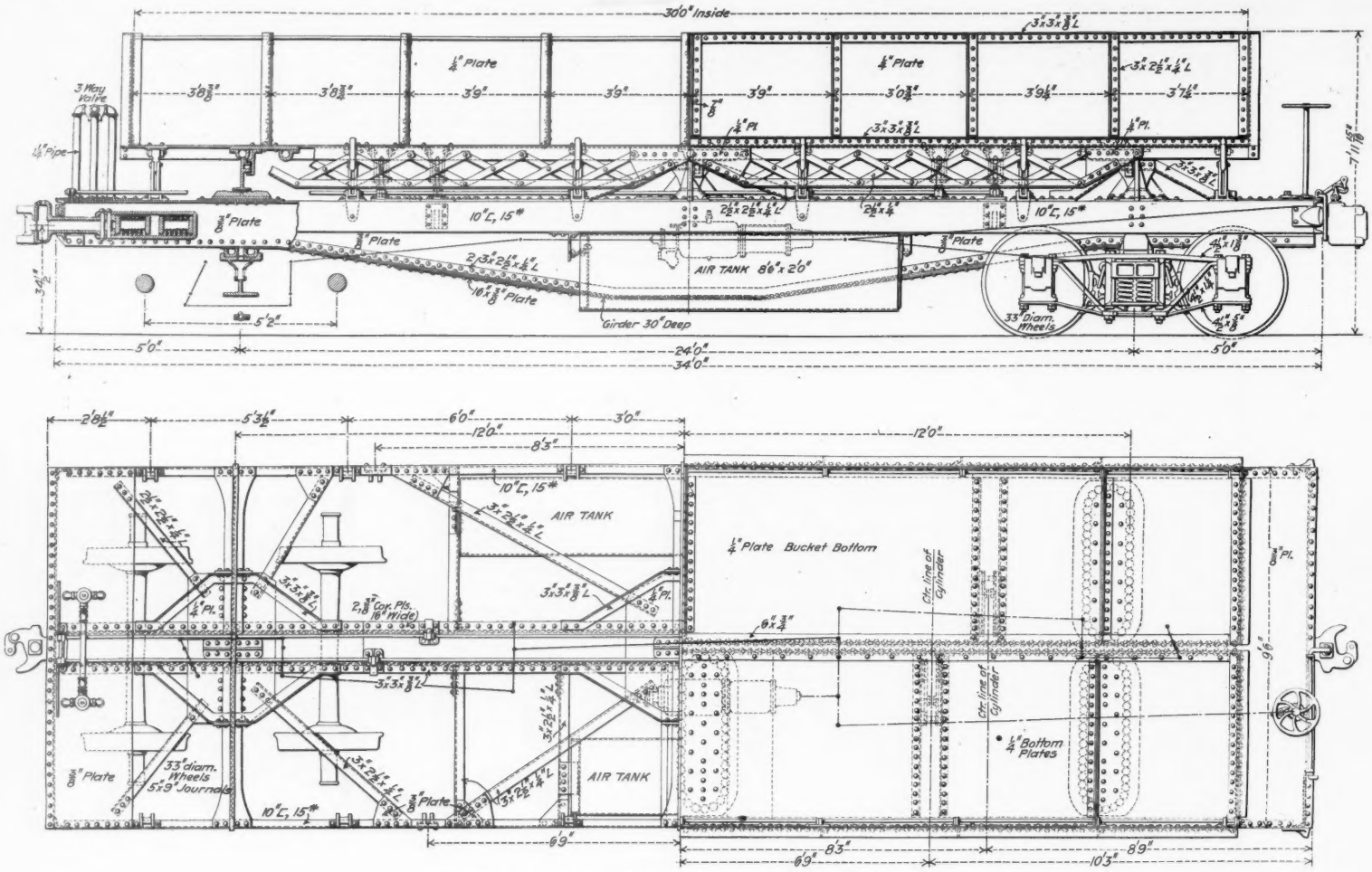
One of the newest designs of dump cars for general service is the Lawson car, shown in the accompanying illustrations. A number of these cars are being built for the Lawson Boat & Car Company, New York, by the Middletown Car Works, Middletown, Pa. The principal features of their construction and operation are covered by patents issued from time to time during the last three years to Thomas Lawson, the inventor. The boxes are dumped and returned to their normal position by compressed air supplied from the locomotive and stored in tanks hung under the frame on each side.

The underframe consists of two plate girder center sills, 30 in. deep at the middle and tapering down to 14 in. over the bolsters, and two 10-in. 15-lb. channel side sills with similar channels for end sills. The bolsters are special two-piece steel castings and the whole underframe is connected together with an elaborate system of diagonal braces and cross ties. The boxes, which are 30 ft. long, 2 ft. 11¾ in. high, and 4 ft. 7½ in. wide, inside dimensions, are carried on three ball bearings, one over each bolster and one at the center of the car. These bearings contain 43, 2½-in. hardened steel balls arranged in a ball race having parallel sides and circular ends which is riveted on the under side of the bottom plate of the boxes. The balls roll on a narrow rail formed on the top edge of a heavy steel casting or bridge which rests on top of the sills, the balls in one side of the ball race only being in contact with the rail.

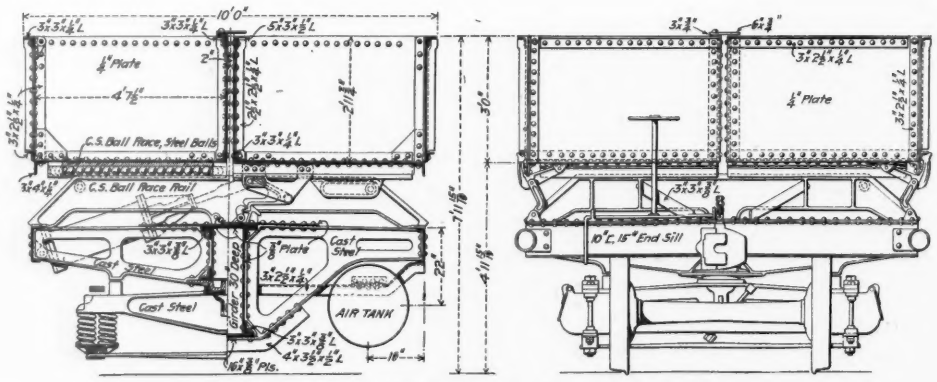
The boxes are built of ¼-in. steel plates bound with 3-in. x 3-in. x ⅜-in. and 3-in. x 2½-in. x ¼-in. angles on the corners. A latticed truss is built along the bottom edge on the outside between bearings, to further stiffen the floor from sagging. The doors are hinged from the top and are locked at the bottom with six catches which are released automatically when the box is displaced for dumping. An L-shaped hook is pivoted at one end to the under side of the box and the other end bears against the angle on the lower edge of the door. A bent link is pivoted at one end to the top of the side sill and at the other end to the L-shaped hook at the bend. The first outward movement of the box before it begins to tip forces the locking mechanism down and releases the door, which then swings clear while the load is discharging.

Two cylinders are provided to each box for dumping, one at each end of the car. The method of attachment of the cylinders to the car frame and to the boxes is shown in the detail drawing. On the first car that was built and which was turned over to the Pennsylvania Steel Company, at Steelton, Pa., for experimental purposes, 9-in. cylinders were applied. These worked satisfactorily when a train line pressure of 70 lbs. per sq. in. could be maintained, but when the car was handled with light switch engines equipped with old air-pumps it was found to be exceedingly difficult to get a pressure greater than 60 lbs. and often it fell as low as 40 lbs. Under these conditions it was found impossible to dump either one of the boxes. As a result of the experiments made on this first car, 12-in. cylinders have been applied to the other cars built so that if they are used with engines having worn-out or second-class pumps, such as are usually found on construction work, the boxes can be dumped with speed and certainty with train line pressures as low as 40 lbs.

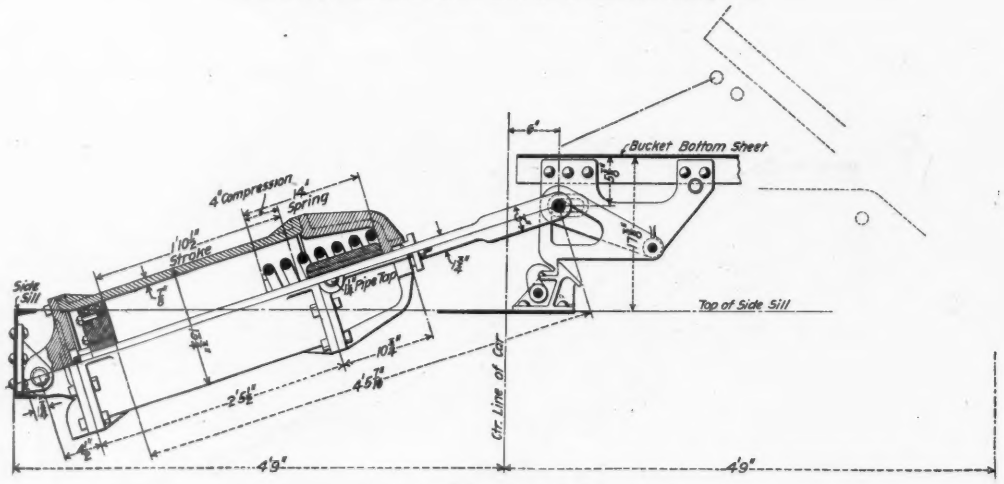
The cylinders for operating the right hand box are pivoted at the back head on a bracket riveted to the left-hand side sill and are placed just inside the bolsters. The pin on the end of the piston rod works in a slotted double bracket riveted to angles on the bottom of the box near the center line of the car. A trigger having a triangular hole



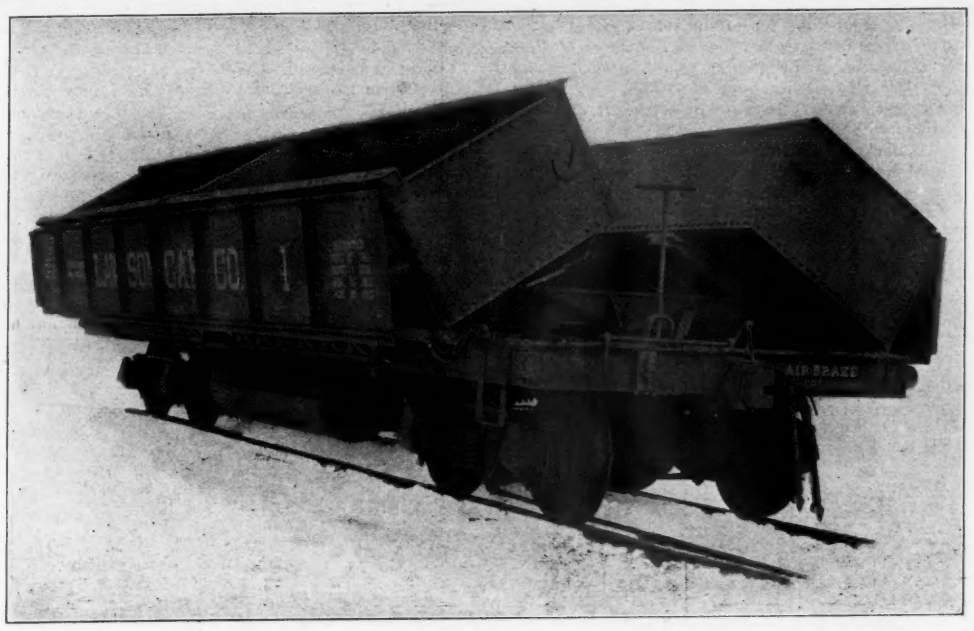

Plan and Side Elevation of Lawson Dump Car.




End Elevation and Cross-Section of Lawson Dump Car.




Detail of Operating Cylinder and Lock.

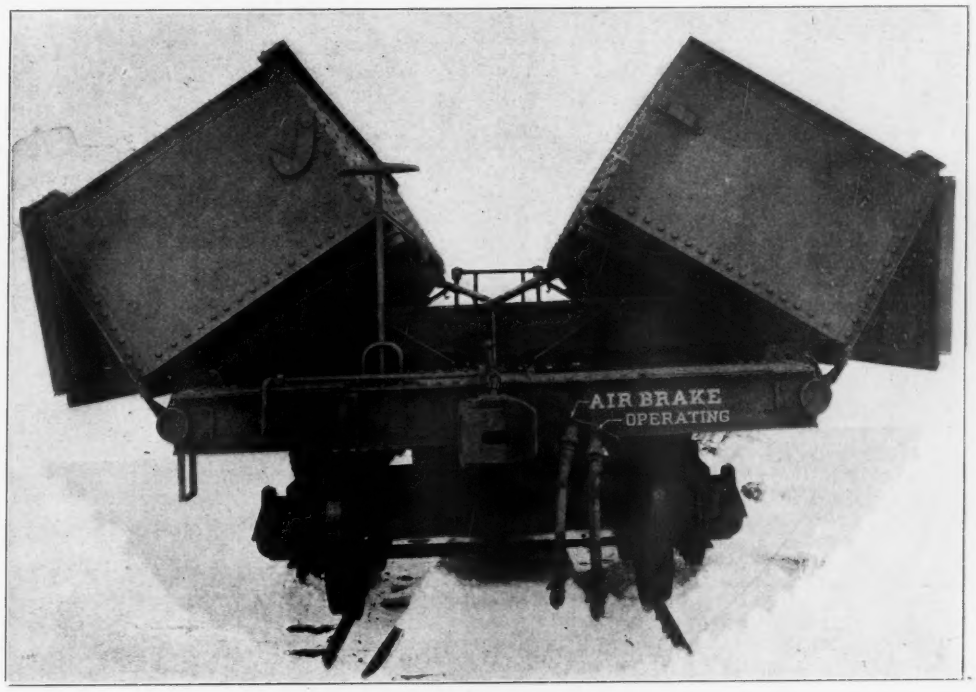


Lawson Dump Car with Both Boxes in Dumped Position.

in the center is hinged at the bottom of this bracket and when the box is locked in its normal position the pin in the piston rod rests in the upper corner of the triangular hole and the catch, which is mounted on top of the center sills, fits over the locking point of the trigger and holds the box rigidly in place. When air is admitted back of the piston the pin on the end of the rod moves out to the outer end of the slotted hole in the bracket under the box and at the same time forces the trigger up, releasing the catch. The further movement of the piston forces the box out horizontally until the center of gravity is beyond the horizontal portion of the ball race rails when the box begins to tip. The doors are automatically released and the load is discharged by gravity. The box can be held in any position by manipulating the air valves and holding the pressure in the cylinder. When the load is all or partially discharged the box can be returned to its normal position by admitting air on the other side of the piston and when it is finally in place the locks drop down in place and the doors are closed and held with the automatic catches. Any number of cars in a train can be operated singly or simultaneously from the cab of the engine or if the engine is cut off, each car is supplied with sufficient air to operate it several times from the reservoirs carried under the frame.

To test the stability of the car with the box on one side being dumped, the car at Steelton was operated with a load frozen solid in the box, but even under these conditions with the load still in the box when it was in its outer position the car was perfectly stable.

The design of the car was worked up by the Commonwealth Steel Company, Granite City, Ill., and the Middletown Car Works built them to the drawings furnished, but with a number of modifications, the principal ones being the omission of diagonal braces from the floor to the top of the sides, inside the boxes, and a change in the method of hinging the doors. The weight of the car is 50,000 lbs. and its rated capacity is 80,000 lbs. A number of modifications are under consideration which will simplify the construction and reduce the weight somewhat and when these are made the car will be an excellent design of positive dump car suitable for handling bulky loads, ballast, refuse material, coal, ore, etc. It is certainly strong enough for any loads which might be put into it.




End View of Lawson Dump Car with Both Boxes Dumped.

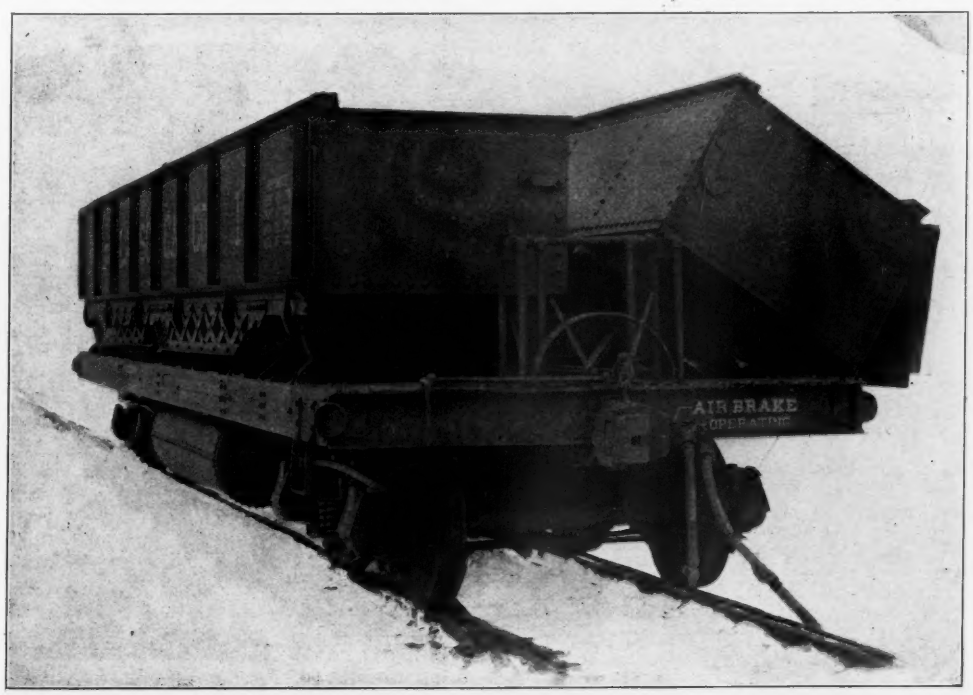
## Fatal Collision on Manual-Controlled Line, Scotland.

The British Board of Trade has just issued a report on a fatal collision that occurred on Sept. 25 on the underground line of the Caledonian Railway in Glasgow.

The signals are manual controlled. The towerman (in this case at the Central West box) cannot accept a train on his block instrument from the tower in the rear (Bridgeton Cross) until the preceding train has passed over an electrical contact attached to the rail and fixed ahead of his own starting signal; nor can the starting signal at the tower in the rear (Bridgeton Cross) be lowered unless the train has been duly accepted by the next tower (Central West). Part of the control apparatus is an unlocking plunger by which the towerman can free himself in case a train is canceled or is side-tracked without passing over the electrical contact. He can also free himself in case of failure of the interlocking between the block instruments and the locking frame.

The collision occurred at 2.30 a. m., and from the evidence it would appear that from about 1.30 to 2 o'clock the man in the Central West Tower was for some reason or other not attending to his duties. About 1.30 a mineral train, having been accepted by Central West, was running from Bridgeton Cross to Central; but the runner, finding the signals at the latter place against him, came to a stand there at about 1.35. Before this train arrived —at 1.32— the man at Central West gave the "train out of section" signal to Bridgeton Cross. This he should not have been able to do until the train had passed over the electrical contact, unless he used the releasing plunger. This is what he did, as the card that is provided as a safeguard against the improper use of the releasing plunger was found broken. Why he "cleared" the line thus prematurely does not appear. When the train actually arrived and came to a stand, the runner, after waiting some time, went to the tower to see what was amiss. The towerman then lowered the signal and the train proceeded on its journey, passing the tower at 2.09. But during the half hour that the mineral train had been waiting a second train was offered to Central West which he accepted at 2.03. Having prematurely and irregularly "cleared" the line he was able to accept this second train, but he treated them both as one and the same train. The first and the second trains were thus in the section at the same moment; but the section being a long one, there was time for the first to get clear. At 2:11 he gave the "train out of section" signal and this allowed a third train to be accepted. The first train in the meantime was in the section ahead of Central West, so that the signals at that place had to be kept at danger, and they were so found by the runner of the second train, who came to a stand at them; and after standing seven minutes the third train arrived and a collision ensued which caused the death of the two enginemen of the third train.

On the occasion of a previous accident arising from similar causes (in August, 1900) the Board of Trade Inspector recommended that with a view of preventing the improper use of the releasing plunger, arrangements should be made to render its use impossible without the concurrence of the men in the towers immediately in advance and in the rear. This would prevent some classes of trouble; but how about cases arising when communication with one of the other towers is broken? Moreover, it has been found that one of the commonest weaknesses of signalmen is to "help each other out." Getting into trouble by "beating the machine" seems to have a great fascination for some signalmen, perhaps in consequence, partly, of the relief from monotony that is afforded by the subsequent effort to concoct a story that will prove the culpable person innocent; and they like to help each other in such a matter. To help a fellow signalman to release himself when such a course is really necessary would, therefore, be looked upon as such a praiseworthy act that the opportunity would be jumped at with the greatest alacrity, and no questions asked. Moral: Use track circuits throughout every block section.




Lawson Dump Car with One Box Dumped and the Other Closed.

## The Chicago, Indianapolis & St. Louis Short Line.

BY F. W. SMITH.*

The Vanderbilt System enters St. Louis and taps the southwest by means of the St. Louis Division of the Cleveland, Cincinnati, Chicago & St. Louis. This fact alone will explain to those familiar with twentieth century railroading why $3,000,000 is being expended in a cut-off which reduces the distance from Indianapolis to St. Louis by 12 miles. This cut-off is known as the Chicago, Indianapolis & St. Louis Short Line, its Chicago connection being via the Chicago & Eastern Illinois line of the St. Louis & San Francisco system from Pana to Chicago.

The work was taken up by the Construction Department of the Big Four early in 1903, and consists of two distinct features:

1. The double-tracking of the old line from Pana, Ill., to a point immediately east of Hillsboro, Ill., together with a revision of grades in this territory, and

2. The construction of a new double-track road of low grades and straight alinement southwesterly from Hillsboro towards St. Louis. The southwestern termination of this cut-off was very naturally at Mitchell, a small town located at the point of convergence of the Chicago & Alton, Wabash and Big Four. As the Big Four and Chicago & Alton are operated as a double-track road from this point into St. Louis, the completion of the cut-off, together with the second track work above mentioned, will make the St. Louis Division a double-track railroad for the first 81 miles out of St. Louis.

The towns of Hillsboro and Mitchell being determined upon as the governing points, the locating problem became simply to obtain the best line connecting the same. Distance was the prime factor and to that end the line was located as nearly an air line as topographical conditions would permit, there being but seven short curves in the entire distance of 44 miles. The gradient adopted is $^{5}/_{10}$ per cent., or 26.4 ft. per mile. The location was further affected by the uniform adoption of over or under crossings where other railroads were encountered. These crossings, four in number, became, therefore, determining points both as to gradient and location.

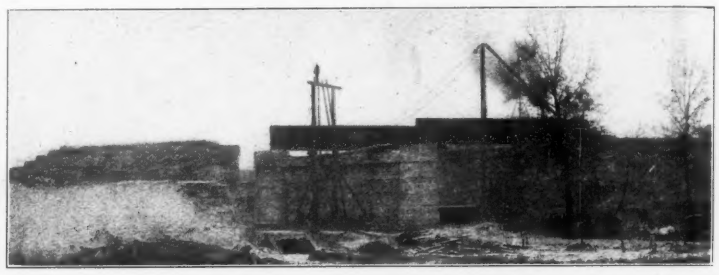
Aside from existing railroads, the chief natural features which influenced the location were, first, the two Shoal creeks encountered a few miles west of Hillsboro. These creeks are crossed by one descent in the gradient, the structures spanning them being within 2,500 ft. of each other. The same two branches are crossed by the old line considerably to the north and at points about eight miles apart, with a heavy hill between. It is here that is saved the major portion of the 12 miles by which the route is shortened. The second natural feature of importance is the high point of the line encountered about one mile west of the Jacksonville & St. Louis Railroad crossing. That this country might be successfully negotiated it was necessary to use a reverse curve after passing the Shoal Creek bottoms. From the above-mentioned summit westerly as far as Worden the country is fairly unbroken. The location here was determined by the subgrade crossing with the Illinois Central and by the town of Worden, a slight deflection being made to avoid the latter. Westerly from Worden, Cahokia and Indian creeks and the necessity of finding a suitable means of crossing over the Illinois Terminal Railroad and at the same time gaining a not too difficult descent to the low country known as the American bottoms were the chief features to be considered.

The operating advantages secured by the new line over the old are made apparent by a comparison, which gives:

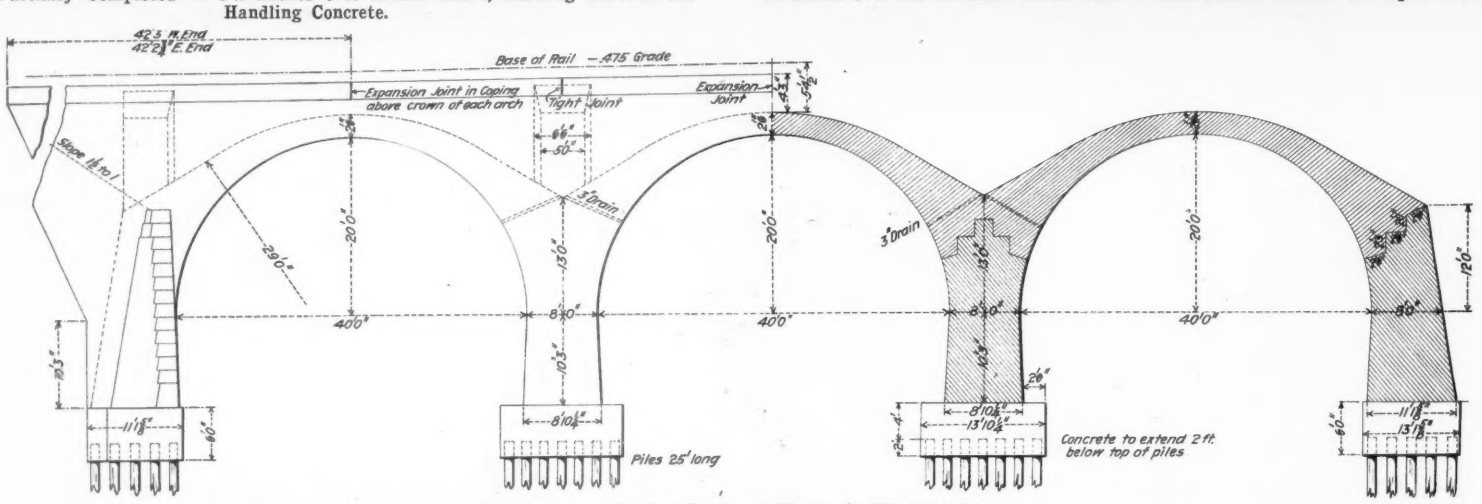
| | |
|---|---|
| Distance, Hillsboro to Mitchell via old line | 56 miles |
| Distance, Hillsboro to Mitchell via new line | 44 miles |
| Degrees of central angle in old line | 948 |
| Degrees of central angle in new line | 129 |
| Maximum gradient in old line | 8/10 per cent. |
| Maximum gradient in new line | 5/10 per cent. |
| Maximum curvature in old line | 4 deg. |
| Maximum curvature in new line | 1 deg. 15 min. |

A word as to the traffic limitations of the old line may be of interest. The heaviest consolidation engines weighing 196,000 lbs. now in use on the St. Louis Division are rated to haul westbound over the ruling gradient 1,200

Partially Completed 40 Ft. Arches over Indian Creek, showing Traveler for Handling Concrete.



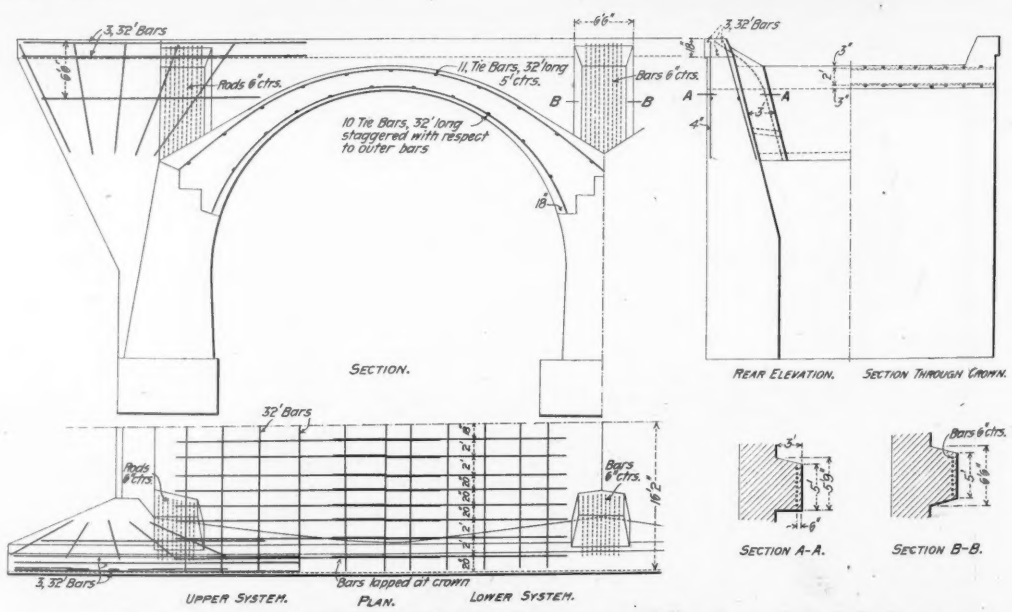
Structure over Ill. Terminal R. R.—The Track Passes Beneath the Span Erected.




Structure over Indian Creek, as Shown in Photograph.

Two 40 Ft. Arches over Lake Fork Creek.

30-ft. Arch near Binney, Ill.



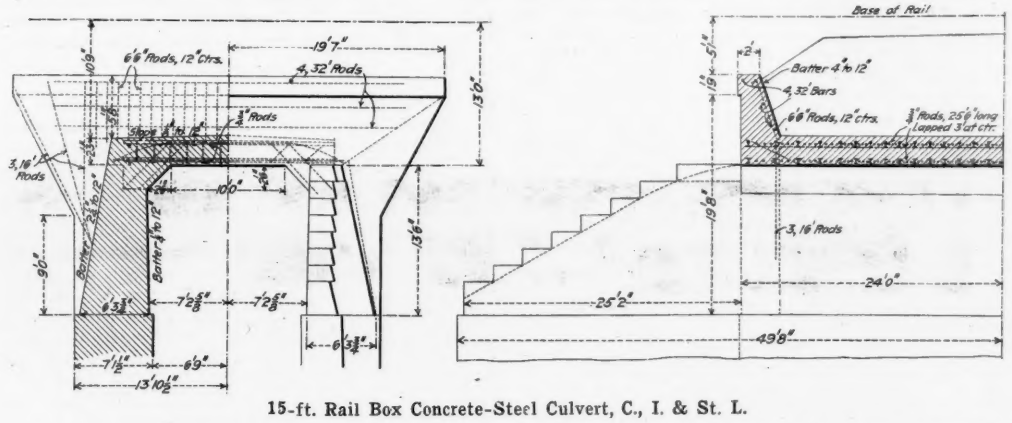

Steel Plan and Sections for Concrete-Steel Structure over Indian Creek, C., I. & St. L.

*Principal Assistant Engineer, Construction Department, Cleveland, Cincinnati, Chicago & St. Louis, Mattoon, Ill.

tons. It is contemplated that the same engines should haul on the new line not less than 3,000 tons when engaged in coal traffic or traffic of a like nature, and about 2,000 tons when engaged in hauling mixed traffic. The development of local traffic was not considered as of importance.

The roadbed adopted as standard is shown in the engravings, the sections shown being net, cuts being widened where greater drainage provisions were necessary, and all fills being built with a view to a liberal allowance for shrinkage both vertically and laterally.

In the execution of the grade work beween Hillsboro and Mitchell a large number of outfits were thrown upon




15-ft. Rail Box Concrete-Steel Culvert, C., I. & St. L.

the work, as many as 20 plants being in operation at one time. It may be remarked here that throughout predetermined districts no restriction was made as to haul—the haul being unlimited in each district—which fact had considerable influence upon the character of plants used. For the large fills at Shoal creeks, Binney (near the Illinois Central crossing) and Cahokia Creek, nearly all material was obtained from adjacent cuts. The haul in several instances was over one mile, to accomplish which steam plants consisting of shovels, engines and dump cars were installed. The work from Hillsboro to Shoal Creek, a distance of seven miles, was handled almost exclusively by steam shovel, the haul being made by trains of 1-yd. dump cars hauled by horses upon an 18-in. gage track. West of Shoal Creek standard-gage engines were used with 5-yd. dumps. The locomotives were full-sized, having been in actual service on the Chicago Great Western. The installing of this plant was a matter of considerable difficulty, as the shovel and two locomotives had to be taken across country over a very hilly route for about five miles. At Binney and Cahokia Creek a 30-in. gage plant was adopted with "dinky" engine and 3-yd. dump cars. It was noticeable that the capacity of these plants was approximately the same, though as the haul was more favorable for the horse-power plant, the quantity excavated per day is not altogether a fair criterion.

Excavating machines of the elevating type were used to a very large extent; in fact, at all points where the volume of excavation did not justify the installation of a steam-shovel plant. The entire fill over the Wabash and the Chicago, Peoria & St. Louis tracks, involving about 450,000 yds., was put up by excavators. The embankments built in this manner are of excellent construction as they become compacted by the action of teams and wagons. In this respect embankments built in the above manner are far superior to steam-shovel fills where the material is dumped from a trestle or shoveled over to one side. The daily capacity of an excavator proved to be about one-half that of a steam shovel. Their usefulness, however, is limited by the length of haul to be made.

Several long strips of light borrow work were handled by wheeler and slip outfits. In such construction it was found difficult to preserve the bermes intact. Otherwise, results obtained have been very satisfactory.

The new roadbed between Pana and Hillsboro is confined to the original right-of-way, which is 100 ft. wide. As the first track is located in the center of the right-of-way the space available was limited—too narrow for the use of machinery of any kind. The means of execution being meagre, all grading work, except at points where grade reduction occurred, was handled by slip and wheeler outfits. While a large portion of the material for fills was obtained from borrow pits, all cuts were hauled to the embankment, no waste being permitted. In a few instances the contractors preferred to waste outside of the right-of-way and to borrow an equivalent quantity of material in pits of their own providing. Of the 26.3 miles of second-track grade work, about 21 miles were handled in this fashion.

The remaining territory involved grade reduction—a cutting down of summits and a raising of sags. That no interruption to traffic might occur, the roadbed for the new second track was first constructed to its final grade, and of such cross-section as to permit of the construction and use of its track superstructure during the time of execution of grade work upon the alinement of the first main track. This work was done by means of narrow-gage plants, the trains of dump cars being loaded by hand and hauled by horses. The haul made in this manner was in some cases excessive, the largest distance hauled being about 1¼ miles. In two cases also it was necessary to haul the material across the main track, this being accomplished by means of a panel of narrow-gage track laid on top of the main track rails which was removed on the approach of trains. The process was safeguarded by proper regulations affecting train movements, as well as the movements of the contractors' dirt trains over the crossings. The temporary grade having been prepared and the track laid and ballasted, the traffic was then diverted, the old track torn up and the work of cutting down the old grade handled in a like manner. This grade reduction work occurred at five different points and was in progress for about five months, during which time no accidents occurred, and no delay to traffic was suffered other than that occasion by running at reduced speed over newly-laid rails. The inconvenience or loss of time to trains on this account was scarcely appreciable. For example, train 18, scheduled at 50 m. p. h., Hillsboro to Pana, lost in no instance to exceed three minutes.

Structures throughout are of a permanent character, being of concrete or concrete and steel. At three points heavy through steel girders are used with a solid-floor system. Smaller waterways are provided for by means of cast-iron pipe. This policy has been followed in making renewals as well as constructing extensions for culverts on the second-track work, so that from Pana to Mitchell there will not be a single bridge tie, nor an opening in the track of any kind.

The accompanying drawings and photographs illustrate the general character of design which has been adopted. Steel rods of the corrugated type are used in arch barrels and in the projecting parapet walls. The design involving this projecting parapet and low wing wall is a little unusual. By its adoption a considerable volume of concrete was saved and it is thought that the base of the projecting parapet being carried up vertically from the footing will act in a manner very beneficial to the entire structure, serving the purpose of a refortment. As the illustrations show this feature very clearly, further comment is unnecessary.

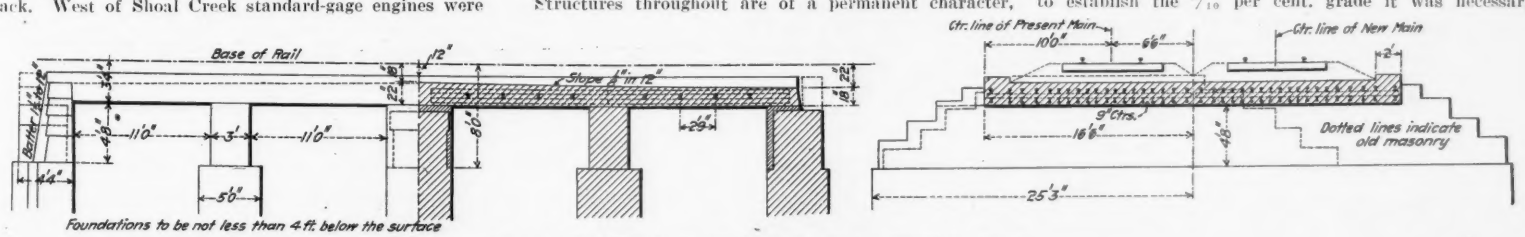
The concrete-steel beam type of bridge is also used, its most general application being at points where the head room is not sufficient to allow of arch construction. Old steel rails and corrugated steel bars comprise the reinforcement of these beams. The application of this form of structure to the renewal of old steel or wooden structures is of interest. The bench walls are carried up to the underside of the beam for both old and new tracks. The top, or beam, is then built in two portions, that for the new track being constructed in place and that for the old track being erected upon temporary falsework to one side and later when fully set is slid into place on rollers, the old stringers being removed and the entire process concluded between the passage of trains, thus incurring no delay or expense for the temporary diversion of traffic.

The bridge by which the Illinois Terminal Railroad is crossed has several points of interest. It consists of two spans, the superstructure being of steel through girders with trough floor system, the east span being over the railroad and the west span over a highway. In addition to this there is in this vicinity a small stream which has been diverted from its original channel several hundred feet and which now passes through a 10-ft. arch under the highway above mentioned and beneath the railroad bridge, the structure thus serving a triple purpose. The saving in turning the stream was considerable, as the 10-ft. arch was proportioned to carry only highway loads, whereas otherwise it would have necessarily passed under a 30-ft. railroad embankment. Economy was also attained by reason of the fact that a culvert foundation in the vicinity of the old stream bed would have necessitated piling, whereas at the present location clay foundations were available. The construction of this bridge was further complicated by the necessity of adopting a severe skew, the two railroads crossing at an angle of 38 deg. A view of this structure partially completed is shown.

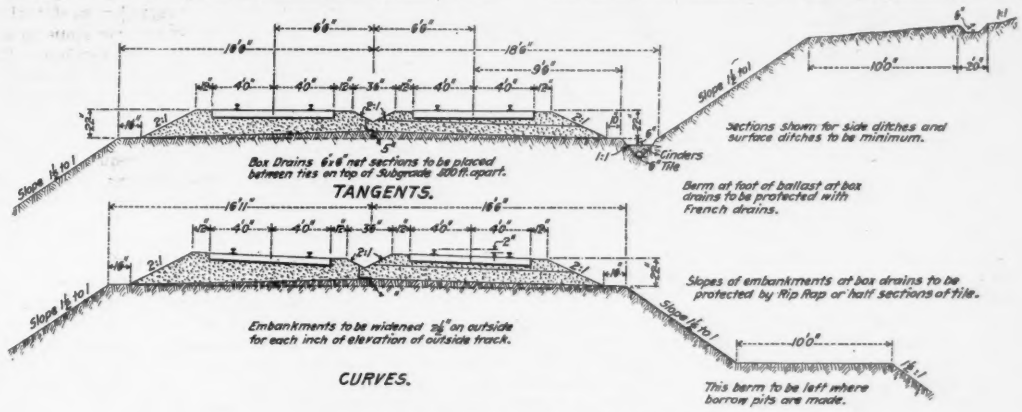
The work of construction as well as the location of the Short Line was affected by the crossing of foreign lines. At the intersection with the Jacksonville & St. Louis it was at first contemplated to establish a grade crossing, but it was decided even after considerable progress had been made in the execution of grade work in this vicinity to establish a separation of grades. To accomplish this it was necessary to raise the Jacksonville & St. Louis tracks and an agreement was reached between the two companies whereby the Short Line was to be depressed 8 ft. and the Jacksonville & St. Louis raised 18 ft. It was further agreed that the approaching grades in either railroad should not exceed $^4/_{10}$ per cent., and also that the change in grade to be made should not interrupt traffic on the Jacksonville & St. Louis. To this end a realinement of the latter railroad was adopted, the new grade being built to the east side of the old line and far enough away not to interfere with its operation. In order to establish the $^4/_{10}$ per cent. grade it was necessary to carry this realinement about a half mile to the north and about 1¼ miles to the south of the point of crossing, the ground being very unfavorable for grade reduction in the latter direction. In addition to the abutments and girders necessary to carry the Jacksonville and St. Louis track over the Short Line, the grade separation involved the construction of a 40-ft. arch and a 14-ft. opening over a public highway. The fill at its maximum is about 40 ft. high and involves a considerable yardage, to obtain material for which it was necessary to purchase considerable additional right-of-way for borrow pits, though the excavation due to the depression of the Short Line was handled into the fill.

The above will indicate that the management was willing to avoid crossings at grade even at a considerable cost, a policy which is further evidenced by the very extreme instance of grade separation in the vicinity of Worden. At this point the Chicago, Peoria & St. Louis and the Wabash are encountered within 1,600 ft. of each other. The country for some miles to the east is very flat, what little slope does exist being toward the west. To the west the ground drops away more rapidly to the Cahokia Creek bottoms.

The tracks of the above railroads were left undisturbed, the gradient of the Short Line being carried up at a rate of $^5/_{10}$ per cent., sufficiently to effect a clearance of 22 ft. The structures over these railroads are of interest owing




Concrete-Steel Replacing Deck Girder Under Old Main Track.




Standard Roadbed and Ballast Sections.

to the extreme skew, both roads being crossed at an angle of about 28 deg., which a little more than doubled the clear span actually required by the foreign lines; the actual clearance required at the Wabash being that for three tracks which necessitated the use of girders 105 ft. in length. At the C. P. & St. L., clearance for two tracks was provided, which brought the east end of the south girder nearly opposite the west end of the north girder. That undue distortion might not occur to the floor system these two ends were fixed and the far ends rotted—a somewhat unusual provision for expansion. Three highways were encountered by the heavy fill, all of which were crossed by concrete arches varying in span from 20 to 25 ft., the arch in one case being built on a skew of 57½ deg. Nearly 7,000 yds. of masonry were involved in these structures.

At Binney a subgrade crossing with the Illinois Central was adopted. The girders to carry the Illinois Central tracks (two in number) were first erected on pile bents driven by a track driver. The earth beneath the bridge was then shoveled out by hand and later the masonry abutments will be erected. It was not possible to drive the piles to a sufficient depth at first and, therefore, a second set of framed bents had to be erected to carry the bridge superstructure after the earth had been partially excavated.

Track-laying has been progressing on such stretches of grade as are available. The track superstructure will be of a high-grade character, 80-lb. rails and a heavy bed of ballast being used. The ties are chiefly white oak and are obtained from Tennessee and other southern points. It is contemplated using as an experiment 10,000 creosoted yellow pine ties.

Block stations are to be established at intervals averaging 4½ miles. The plants will be mechanical except at Pana, Nokomis and Mitchell, where all-electric plants are to be installed. In the mechanical plants, however, the distant signals are to be operated electrically, an indication of the position of the semaphore being given to the towerman. Distant signals are in no case less than 2,500 ft. from the home signal. Signal castings throughout are of the universal type recommended by the American Railway Engineering & Maintenance of Way Association, and are so constructed that when specially desired the upward position of the semaphore blades may be given, indicating "proceed at full speed to the next station and take siding."

It is contemplated that train operation between Pana and Mitchell will be governed by the same rules which are now in effect governing the operation of trains over the double track between East Alton and East St. Louis. The special features involved in this method of operation may be expressed briefly as follows:

No trains are superior by class.

All train movements, excepting under abnormal conditions requiring the use of train orders, are governed by block signals, the functions of which will appear in the following excerpt from the special instructions:

301. The governing arm of semaphore is displayed to the right of the signal mast as seen from an approaching train, and the indications are given by positions:

(a) Horizontal, indicates "stop."
(b) Vertical downward, indicates "proceed."
(c) Diagonal upward, indicates "proceed and clear main track at next siding."

Night signals:
Red is the equivalent of (a) "stop."
Green is the equivalent of (b) "proceed."
Yellow is the equivalent of (c) "proceed and clear main track at next siding."

302. Block signals control the use of blocks, but do not dispense with the use or the observance of other signals whenever and wherever they may be required.

Freight terminal facilities are to be provided at Mitchell. The plan for a gravity yard submitted herewith is now under consideration.

The mechanical interlocking plants are to be installed by the Pneumatic Signal Company, Rochester, N. Y.; the all-electric plants by the Taylor Signal Company, Buffalo, N. Y. The contract for the all-electric plant at Pana has not as yet been let.

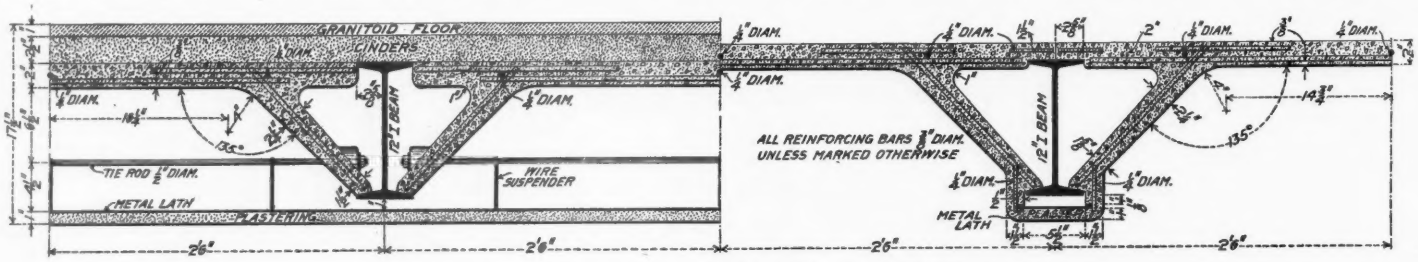
The grade work on the Short Line and second-track work has been handled by the MacArthur Brothers Company, of Chicago. The masonry work by Yawger & Battefeld, of Indianapolis. On the Jacksonville & St. Louis realinement, the grade work is being executed by the firm of Wells Brothers, of St. Louis, and the masonry work by the Bates & Rogers Construction Company, of Chicago.

At the present writing all grade and masonry work between Pana and Hillsboro has been completed and 18 miles of the second track is in service. Of the 3,000,000 yds. of earthwork in the cut-off, about 95 per cent. has been completed, and of the 35,000 yds. of masonry, about 87 per cent. has been completed. It is hoped to accomplish the completion of the cut-off by July of the present year. The work was carried out under the supervision of Mr. W. M. Duane, Superintendent of Construction, assisted by the writer.

## A New Design of Concrete-Steel Floor Slab for Bridges and Buildings.

The accompanying drawings show two slightly different forms of a fire-proof concrete-steel floor slab or unit for bridges and buildings, designed and patented by Edwin Thacher, M. Am Soc. C. E. The principle of design and reinforcement is the same in both; the only difference is in the method of supporting the ends of the slabs on the floor beams. In the section shown on the left, the lower end of the diagonal strut rests on the bottom flange of the I-beam and carries all of the load at that end. The horizontal extension of the slab beyond the diagonal strut fits closely against the edge of the upper flange of the beam with its top surface flush with the top of the flange. The cinder backing for the granitoid floor is laid over the slabs and I-beams to a thickness of 2½ in., and on top of this is a layer of granitoid, 1 in. thick. Metal lath and plastering is suspended from the tie rods with wire hangers, 1 in. below the bottom flange of the floor beams. This construction is especially adapted for buildings requiring a continuous floor and ceiling. The other form shown on the right has two points of support on the flanges of the I-beam. The horizontal extension rests on top of the upper flange and the diagonal strut extends down below the bottom flange, having a projecting shoulder formed on it which bears on the flange. The space under the floor beam is spanned with metal lath and plaster to protect the steel work. This form is better adapted to bridge floors and viaducts and effectually protects the steel framework from exposure to corroding fumes, gases or smoke.

The design of slab shown is capable of supporting a uniformly distributed live load of 150 lbs. per sq. ft. with a factor of safety of 5 with a span between floor beams of 5 ft. They can be made in any suitable width from 2 ft. to 4 ft. The reinforcement consists of longitudinal Thacher bars placed near the bottom of the main body of the slab and spaced 6 in. apart across the width; transverse bars, one at the center of the span and one over the diagonal struts; bars in the strut spaced 6 in. apart and extending up into the body of the slab and additional reinforcements near the top surface over the strut. For the load assumed all of the bars are ⅜ in. in diameter except those marked ¼ in. on the drawing. The concrete is assumed to be under no tension and the bars are of sufficient section to carry safely all of the stresses of that character and to provide strength against shear. In the design for buildings the tie rod which is inserted takes up any thrust on the floor beam.




Concrete-Steel Fireproof Floor Slab for Bridges and Buildings.

The principal advantages of this system of floor construction are, strength, low first cost, rapidity of erection, economy of material and reduction of dead load. The units can be made in advance of the erection of the building and when placed have attained a large percentage of the ultimate strength of the concrete. They may be made on edge in molds either by pouring or ramming, preferably with a 1:2:4 mixture of concrete using as large stone as is possible, consistent with the thickness of the sections. If the forms are poured, the reinforcing bars are supported on nails driven through the molds which are withdrawn as soon as the concrete has set sufficiently to support the weight of the bars. This method requires more molds than the ramming method, since the forms require a longer time to set when poured wet. No centering is required during erection and the floor, when placed, is strong enough to support any building material which may be stored under cover. The shape of the slab reduces the actual span and results in a large reduction of weight of material for the same strength. All of the steel beams in the floor structure are enclosed and protected against corrosion or fire. A semi-circular groove is formed on both edges of the slabs and when they are placed in the floor these grooves are filled with mortar which, when it sets, forms a doweled connection between adjacent slabs and distributes the load immediately over the joint, uniformly over both slabs.

The Concrete-Steel Engineering Company, New York, controls the patents on this construction.

## The Ice in Lake Michigan.

The following account, reprinted from the *Marine Review*, shows what the car ferries in Lake Michigan have had to contend with this winter:

Never before in the history of the Pere Marquette car ferries have they experienced such a terrific winter. The slush ice this winter is fully double what it has been any winter since the car ferries have been running on Lake Michigan. During the whole month of February, Lake Michigan has been entirely frozen over with the exception of a few spots of open water here and there which were partly frozen with a thin sheet of ice which broke up and refroze continually. The condition of the ice in the bay at Manitowoc is as bad as any place on Lake Michigan with the possible exception of Ludington, Mich., the other terminus of the Pere Marquette car ferries' run. On Feb. 13 the No. 15 was in the ice near Kewaunee. The No. 18 was sent light from Ludington to release her. When within sight of Kewaunee the No. 18 could see nothing of the No. 15 and concluded that the No. 15 had entered the harbor. No. 18 then went back to Ludington. After loading her complement of cars, she again started for Manitowoc. When within sight of Two River Point she could see No. 15 fast in the ice. The No. 18 then started after the No. 15 and after cutting her out they both started for Manitowoc, the No. 18 leading. When within five miles of Manitowoc in Manitowoc Bay, the No. 15 concluded that she could make better time by herself and started to cut a new channel past the No. 18. In so doing she finally was held fast in the ice. She then blew for the No. 18 to check down and as soon as the No. 18 had checked, she too became fast. To add to their troubles, the ice at this time commenced to jam in towards the beach carrying the car ferries with it and wedging them in with terrific force with about 25 to 35 ft. of water under each car ferry. The position they finally came to was within a mile of shore and about a mile from each other, with ice piled as high as the main deck. To keep the propellers from freezing in they kept the engines moving continually. Early Monday morning of Feb. 15 car ferry No. 17 started from Milwaukee to release them, arriving there about noon. Then started a terrific battle with the ice which lasted for four days. The ice was plowed foot by foot and thrown up to a height of 15 ft. on either side of the ferries, presenting a regular wall channel in which the No. 17 would return as far as the harbor now and then to keep it open so as not to allow herself to be closed in. The thermometer was below zero through the days that the car ferries were imprisoned. The No. 17 finally reached the No. 18, which was nearest the harbor, and manœuvred back and forth in the ice in a radius of a quarter of a mile on either side so as to get room to work the ice away from the No. 18. In places the ice seemed to go clear to the bottom, for when the propellers were worked strongly the ice was turned up, bringing sand from the bottom deposited on the cakes. It took the No .17 from Monday noon of Feb. 15 to Tuesday afternoon, Feb. 16, to release the 18. Then together they started for the No. 15, a mile away, plowing through windrows that seemed almost impassable, and when one car ferry became fast the other would plow her out. They finally succeeded in reaching the No. 15 after cutting a parallel channel and working the ice back of them. Together they worked the greater part of the night, cutting out the No. 15 which had become imbedded in heavy windrowed ice, finally releasing her about 7 o'clock the morning of the 17th. Then all three started for the harbor, presenting a very fine appearance, and reminding one of the victor's return from battle. After a few hours of hard plowing they finally succeeded in getting into the harbor and into the slips. Thus ended without doubt the worst battle that they have experienced during the time the Pere Marquette car ferries have been running on Lake Michigan.

## Steel Underframes for Passenger Cars.

A bill was introduced in the lower house of Congress on March 3, by Mr. Esch, providing that after Jan. 1, 1906, it shall be unlawful for railroads to build any "day or passenger coach, mail car, chair, smoking or combination car, or tourist sleeper," which does not conform to a specification following. This specification requires the use of steel side and end sills and not less than four steel center sills continuous from end to end of the car, including the platforms, the whole to be covered with a steel floor of ¼-in. plates. It also requires a steel vertical framing for the vestibules and a steel or metal body framing with metal roof frames. The American Railway Association is authorized to designate to the Interstate Commerce Commission models or standards for the classes of cars affected by the act, and for the purpose of supplying funds for preparing these standards $5,000 is to be appropriated. After Jan. 1, 1915, it is made unlawful to run any car, whether old or new, which does not conform to the standard established. The penalty for violation is $1,000 fine for each car built or operated. Electric cars are expressly excluded, and it will be noted that standard sleeping cars, as now built by the Pullman Company and others, are not included in the classification of cars affected. The bill was referred to the House Committee on Interstate and Foreign Commerce. The report that the bill was promoted by the Interstate Commerce Commission appears to be unfounded.

## The New Freight Terminal of the Monon at Louisville.

Louisville is the most important gateway on the Ohio River for traffic to and from southeastern territory. Five lines enter it from south of the river and there are four outlets on the north, three of which run to Chicago. Of these latter the Chicago, Indianapolis & Louisville (Monon) has perhaps the best facilities for handling through trains between these important termini in the minimum possible time, since it has no large intermediate terminal points to cause delays.

The freight terminals of the road in Louisville are in the northwest part of the city, just west of 14th street and the Pennsylvania tracks, between Duncan and Rowan streets. These terminals, which the road has used from its beginning, were outgrown some time ago and additional property was needed before the facilities could be enlarged. A tract two blocks south, extending from Main to Market streets, was therefore quietly bought. The frontage on Market street is 110 ft. and on Main 80 ft., both important streets, making the site an expensive one. Work has begun on the new terminals, the contract having been let in the latter part of February. The Monon proper terminates at New Albany, Ind., across the river from Louisville, and enters the latter city over the tracks of the Pennsylvania, with which it has a traffic arrangement. The C., I. & L. is an Indiana corporation having no charter rights in the State of Kentucky other than its acquired rights to use the tracks of another road in Louisville. The Terminal Warehouse Company of Louisville was therefore incorporated to build this new terminal which will be leased to the C., I. & L. for its use. One of the engravings shows the plan of these terminals, also the tracks of the Pennsylvania in 14th street and the terminals of the B. & O. S. W. The track farthest west in 14th street belonged to the latter and the Monon bought a half interest in it, giving a line of its own between the old and new freight houses.

After wrecking the buildings occupying the property, the only work needed to put it in condition for the new freight house was a small amount of grading and the construction of a sewer. The freight house will be 420 ft. long, 40 ft. wide for 195 ft. of its length and 30 ft. wide for the remaining 225 ft. This reduction in width at the north end was necessary in order to leave a driveway of suitable width on the west side, the width of the driveway at this point being 32½ ft., while at the south end it is 52½ ft.

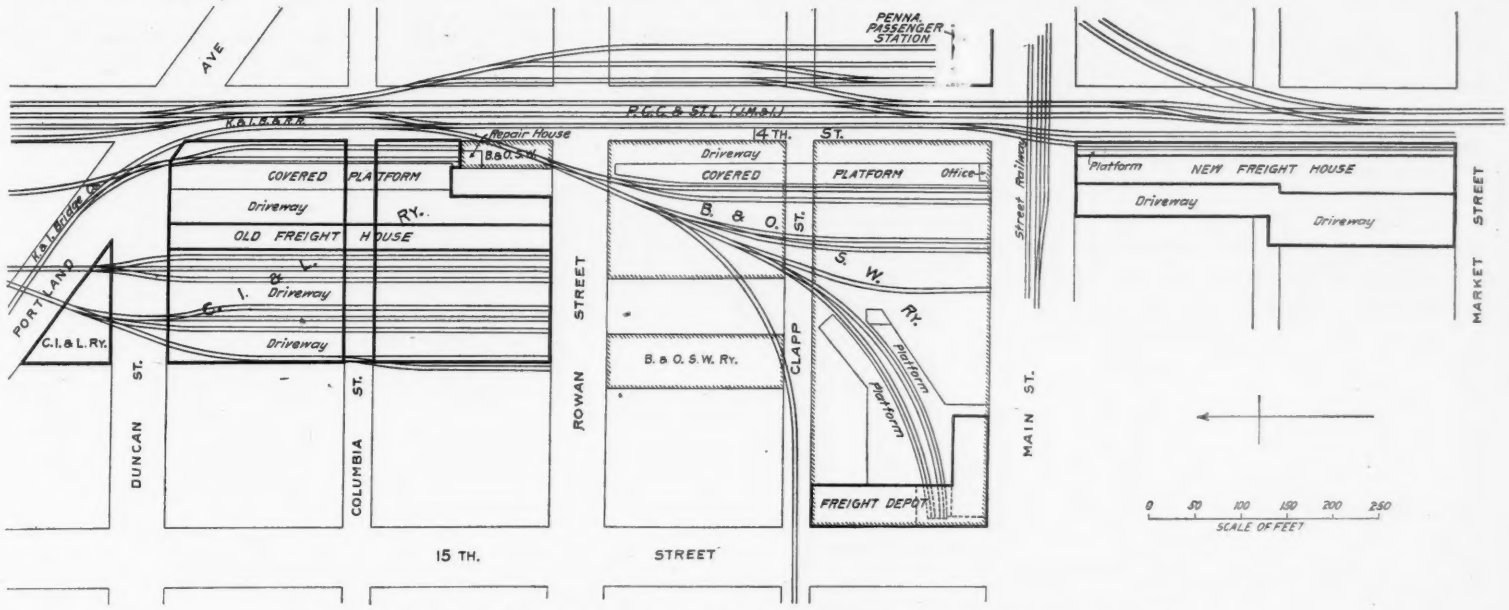
The building will be a two-story structure resting on stone foundations on concrete footings. The walls will be brick with stone facings, the thickness of wall being 17 in. and of pilasters 25 in. Columns, joists, rafters, etc., will be timber and the roof will be covered with a fireproof material, not yet determined upon. The flooring will be ⅞-in. x 6-in. pine, laid transversely, with 2-in. x 6-in. oak laid diagonally above. The office floors will be maple. The interior of the halls and offices will be finished in southern pine. The doors on both the track and team sides will be folding doors made by the Variety Manufacturing Company, the upper half of which will contain wire-glass transoms. There will be a 6-ft. platform on the track side.

The narrow end of the house will be used for outbound freight and the wide end for inbound. The second floor of the latter is intended for storage use. The offices and record room will occupy all of the second floor of the outbound end except 80 ft., which will also be used for storage. Two 5-ton electric elevators will be installed to serve this second floor, one being near the middle and the other at the north end of the inbound end.

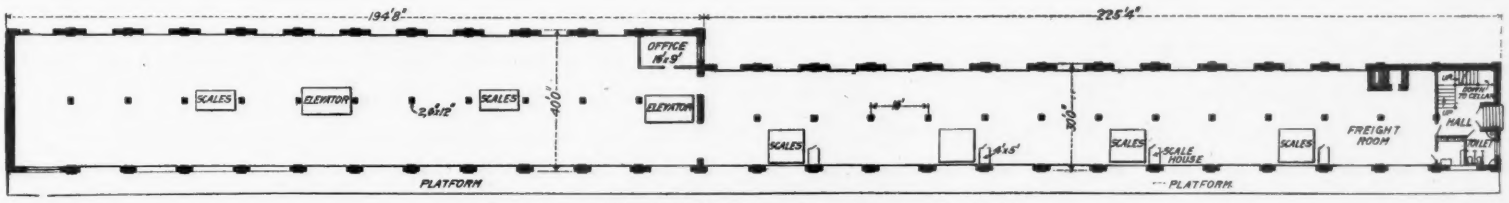
The house will be lighted by electricity and heated by a hot water system. At the north end of the building there will be a basement 90 ft. long for the heating apparatus, and also for an electric lighting plant in case it is decided to put one in. For a time at least current for lights and elevators will be bought.

The old facilities which have been outgrown include a freight house 420 ft. x 30 ft. and a covered shed 300 ft. x 30 ft., both of timber construction. The former will be torn down, but the latter will be retained and used for bulky freight, such as tobacco, iron pipe, etc. The team tracks west of the old houses will be increased in number as necessity requires.

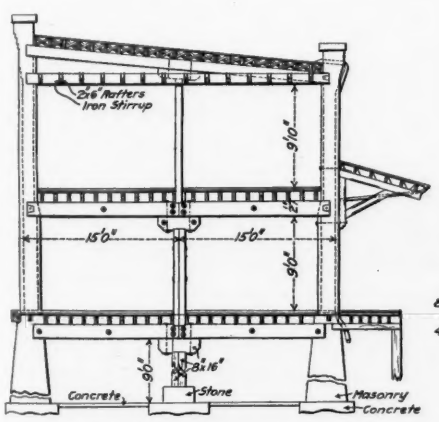
When this work is completed the facilities at Louisville will be about equal to those at Chicago. Of course, the plans for Louisville were made with an eye to future, as well as present, demands. It is expected that the building will be ready for occupancy about July 1. The cost of the structure, exclusive of the ground, will be about $45,000. We are indebted to Mr. W. A. Wallace, Division Engineer, Chicago, for the data for this description.



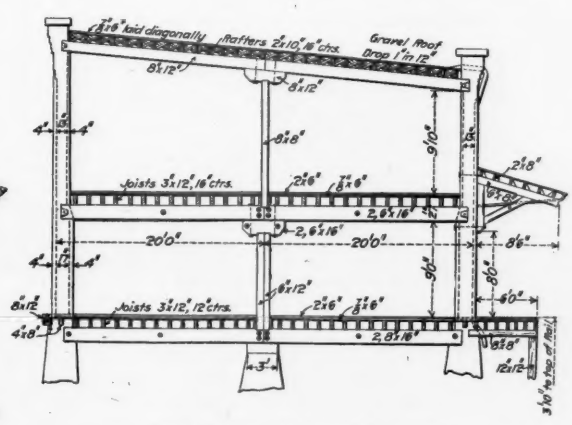

General Plan of Freight Terminals of the Chicago, Indianapolis & Louisville at Louisville, Ky.



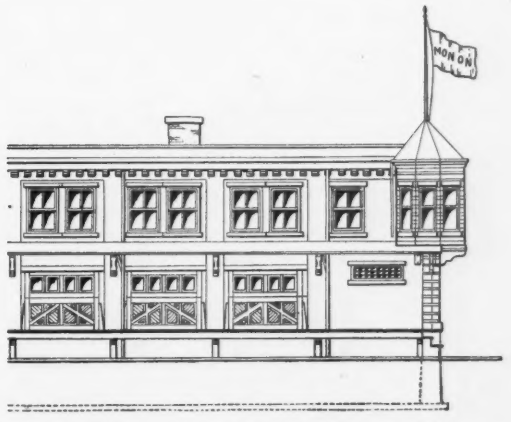

Floor Plan of New Freight House of the Monon at Louisville.




Cross-Section of Outbound House.




Cross-Section of Inbound House.




Part Side Elevation of Freight House and Office.

## A New York Merchant's View.

The position of the New York railroads has been taken after great deliberation and their present fight against the differential in favor of grain going to Philadelphia is a permanent fight; and so far as the Vanderbilt lines are concerned is a business proposition just as much as their previous apathy was a settled business policy. So long as grain was going by way of Boston it was going over Vanderbilt roads and the Vanderbilt people could well afford to reserve their facilities over their New York lines for freight paying high rates. The same conditions existed in the case of the Virginia ports. But an entirely new situation has now been created. Instead of allowing the grain and other freight to go to Boston and to Newport News the Vanderbilts find they are not getting any grain at either New York, Boston or the Virginia ports. In other words, they are not getting any at all. The grain is now going either by the Gulf or by the Canadian routes. And the Vanderbilts have come to the conclusion that they have lost money by attempting to drive business in unnatural channels, and they have come to the conclusion that New York is the natural shipping point for the Atlantic. Only by high charges can business be driven elsewhere. Moreover, there is always a preference given grain exported from New York as a result, to a large extent, of the more severe inspection at this port. In addition to this, New York has such an enormous local trade that grain may be sent here for either export or local business and always find an outlet. —*Journal of Commerce* (New York).

### Baltimore & Ohio Export Pier at Locust Point.

Work is nearing completion on the new Baltimore & Ohio export pier at Locust Point, Baltimore, which is the largest pier of this type on the Atlantic seaboard. The general situation at the Locust Point terminal is shown in the accompanying sketch map. In connection with the yards, there were previously two long piers extending in an easterly direction, with additional docks and shorter piers. The Baltimore service of the North German Lloyd Steamship Company docks at the Baltimore & Ohio piers, and the increased size of the steamers recently built required better accommodations than were previously afforded. The new pier runs approximately at right angles to the former export piers, and extends to the Port Wardens line, 600 ft. from the former bulkhead, on the east side. The total clear length on the west side will be about 850 ft. The dock on the west side of the wharf is to be 200 ft. wide, with 32 ft. of water, and this dock is to be flanked with a bulkhead meeting the elevation of the surrounding ground.

The superstructure of the wharf is 796 ft. long and 138 ft. wide, with a batter of 3 ft. 6 in. from the lower deck to the eaves of the roof, and the sides and ends are covered with corrugated galvanized iron, with a tin roof. There are two tracks on the lower floor, depressed 4 ft. 3 in., and on the upper floor there is a single track, depressed 4 ft., top of rail to floor. The upper floor is supported on wooden piles.

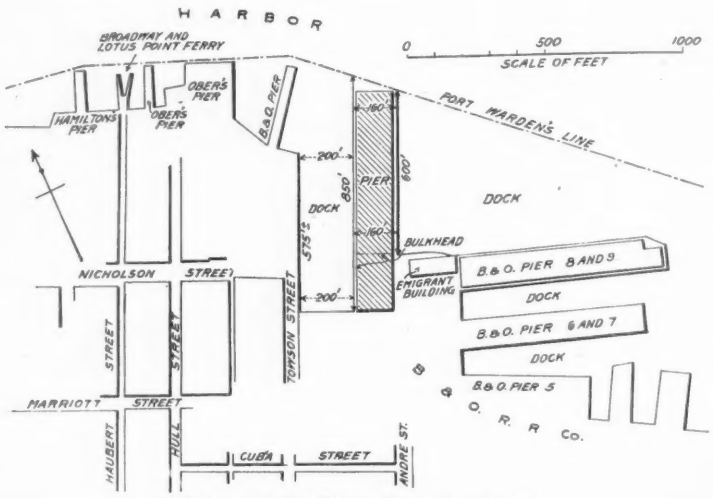
The specifications called for bearing and spur piles to be of sound, straight Virginia or Delaware yellow pine, with all fender piles of white oak. Each row of piles has one fender pile on each side, and every second row a spur pile on each side. Each outshore end of the pier is protected by eight corner piles. To facilitate lighterage, the outer end of the pier, which is not covered by the superstructure, is depressed 4 ft., except for a platform on each side which extends to the end of the pier flush with the main floor. The southern, or inner end of the pier, rests on solid ground, and is supported also on piles, driven 30 ft. below the surface.

New Baltimore & Ohio Export Pier at Baltimore.

At the outer end of the pier a portion 200 ft. long is partitioned off as a bonded warehouse. The partition is of corrugated iron and is required by government regulations to extend from the bottom to the top of the superstructure. The pier is ventilated with 36-in. iron shafts, 30 ft. apart. The type of these is shown in the drawing of the cross-section of the pier.

The steamship office, 17 ft. x 39 ft. 6 in., and the railroad office, 17 ft. x 20 ft. 6 in., are on the lower floor of the wharf. On the second floor is a waiting room for cabin passengers, 30 x 55 ft., a general waiting room for emigrants at the south end, 124 x 67 ft., a restaurant, etc. The baggage room, 127 x 67 ft., is also located on this floor, with a chute leading to the floor below. Electric hoists are provided and there are two 4-ton electric elevators to be operated at a speed of 60 ft. per minute. The total floor space of the wharf is about four acres.

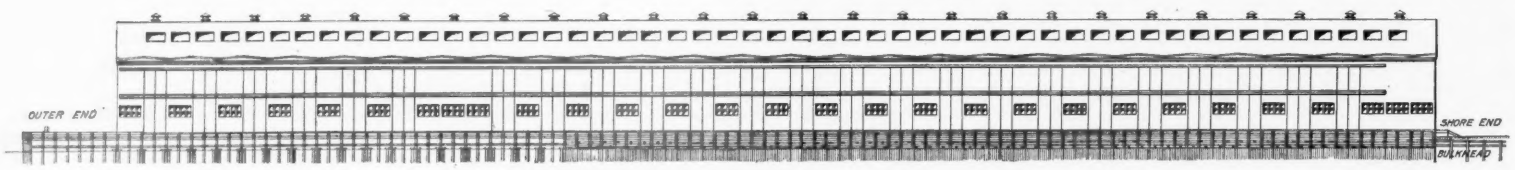
We are indebted to Mr. W. Ancker, Superintendent of Floating Equipment, for information and drawings kindly furnished.



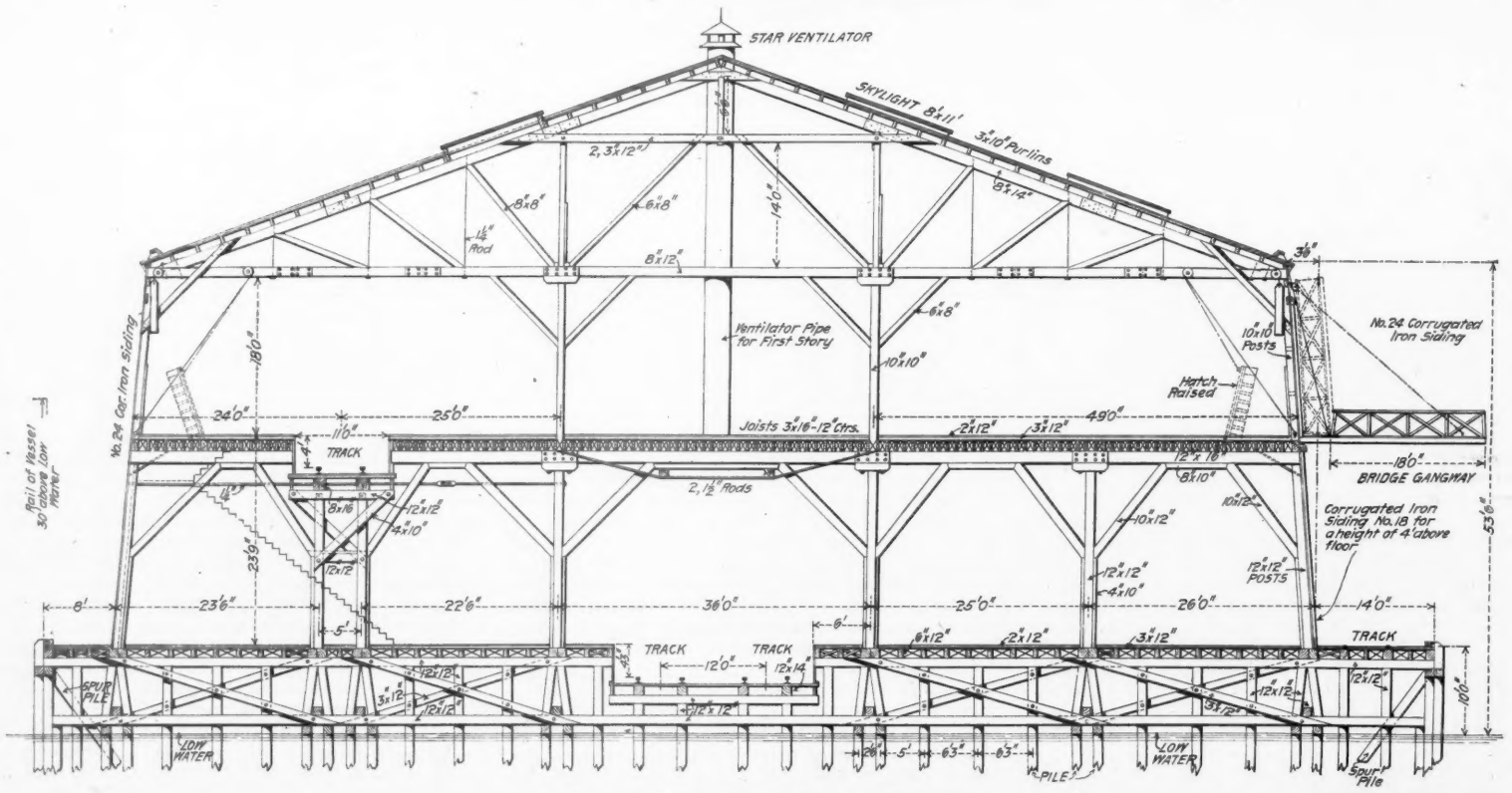

The Locust Point Piers; New Pier Shaded.

### Durability of Paints for Protection of Structural Work.

Mr. Robert Job, chemist of the Philadelphia & Reading, read an interesting paper before the Franklin Institute on Feb. 18, giving the results of an investigation which he had conducted on the durability of paint for steel work. On the Philadelphia & Reading for a number of years three standard paints were in use, a red body color and brown and green trimming colors, known respectively as Nos. 8, 10 and 12. A chemical analysis of these three classes of paints showed them to have substantially the same composition, but their durability in service showed wide variations. The general composition of all of the paints was 22 per cent. of sesquioxide of iron and 78 per cent. of hydrated sulphate of lime and argillaceous gangue, ground in raw linseed oil and diluted for use with japan and raw linseed oil. The relative durability of the three paints in service was substantially as follows: The No. 8 paint under ordinary conditions had a serviceable life of three years. The No. 12, applied on the same structure as No. 8, gave a serviceable life of more than six years, and the life of No. 10 was intermediate between the two. An examination of a bridge which had been protected with No. 8 and No. 12 paint four years previously showed that the parts coated with No. 12 were in good condition and were without rust spots, the metal being clean and bright under the paint. Parts on the same bridge coated with No. 8 paint were badly pitted and covered with rust. Another case under examination showed that parts protected with No. 10 paint were in better condition than those protected with No. 8, but its protective qualities were considerably inferior to No. 12.




Elevation of Superstructure, Baltimore & Ohio Export Pier.




Cross Section of Pier, Showing Tracks on Both Floors.

A chemical analysis of these three paints showed the following composition:

| | No. 8. | No. 10. | No. 12. |
|---|---|---|---|
| Silica | 9.35 | 17.07 | 34.10 |
| Alumina | 4.44 | 5.06 | 19.56 |
| Sesquioxide of iron | 21.07 | 22.74 | 25.24 |
| Sulphate of lime, hydrated | 64.70 | 52.21 | 10.66 |
| Alkalies | *.44 | *2.92 | .49 |
| Water combined with iron & clay | | | 9.75 |
| Prussian blue | ... | ... | 2.10 |
| Carbon black | ... | ... | .32 |
| Free sulphuric acid | None | None | None |
| Calcium carbonate | None | None | None |
| | 100.00 | 100.00 | 100.22 |
| Total water combined | | | 11.88 |

*By diff.

It will be seen that each pigment contains about the same percentage of sesquioxide of iron and of inert filler. Inasmuch as the sesquioxide of iron is the active protective component and it is the same in each case it is difficult to explain from the chemical standpoint, the variation in relative durabilities.

Having found no cause for the difference in durability due to different chemical compositions, an examination was next made of the physical condition of the pigments under consideration. A microscopic examination showed that the average size of the particles in the pigment of No. 8 paint was greater than the average size of the particles in the No. 10, and those in No. 10 were in turn of larger diameter than those in No. 12. The No. 12 pigment contained only a small proportion of particles more than .001 of an inch in diameter, while in the No. 8 paint there was a relatively large number of particles having a diameter of .013 of an inch. The average diameter of the particles in No. 8 pigment was about .008, while that of the No. 12 was about .0004; thus, the average volume of a particle of No. 8 pigment was about 8,000 times greater than the volume of the average No. 12 particle. This difference in fineness of the pigment explains for the greater part the differences in the durability of the three paints. By painting vertical glass surfaces with color coats of the different pigments mixed with raw linseed oil and japan, according to the regular formula for service work, and then drying out the placques, it was possible to examine the structure of the paint coating.

The No. 8 paint showed relatively large oil spaces around the particles of pigment. In the No. 12, the finer particles were piled up in several layers and effectively broke up the structure of the oil film. In the No. 10 paint there was the same general structure as in the No. 8, but less space between the particles. From the appearance of the No. 8 paint it was shown that the oil film could not support the large particles of the pigment and that they were therefore gradually dragged down and separated. The efficiency of a protective paint for structural work has been shown to depend on the condition of the surface of the pigment. If the surface can be preserved while the linseed oil is drying out and a compact mass of particles of the pigment spread evenly over the surface to be protected, water and the other elements which cause rusting can be effectively kept away from the surface; but, on the other hand, if the oil film is depended upon to prevent the entrance of moisture below the surface, when the particles of the pigment are separated by relatively large distances, the result is unsuccessful, since the linseed oil in drying out becomes more or less porous. Fineness of the pigment has always been recognized as one of the important considerations in preparing a suitable paint for protective purposes, and this investigation of Mr. Job corroborates a well-known fact.

In order to determine a practical method of testing paints for fineness, and therefore to some extent for durability, a modification of the ordinary test for fineness was developed. The old test consisted of diluting five parts, by weight, of the pigment, with four parts, by weight, of raw linseed oil, mixing thoroughly and placing a few drops on a clean, dry glass plate standing vertical, and allowing the paint to stand for 20 minutes in a temperature of 70 deg. F. This specification called for no separation of pigment from oil. Since all three of the former standard paints easily passed this test, its severity was increased until the No. 12 paint would just pass, and both the No. 8 and the No. 10 showed decided separation of the pigment from the oil. The temperature was raised from 70 deg. to 100 deg. F, and the proportion by weight changed to four parts of pigment to 10 parts of oil. The time of exposure was also increased to one hour.

The next step in the investigation was to build up a new pigment having substantially the same properties as the No. 12 paint. The composition of No. 8 paint was found to be approximately 35 per cent. of calcined metallic iron pigment and 65 per cent. hydrated sulphate of lime. No. 10 was composed of 52 per cent. of hydrated sulphate of lime and 48 per cent. of an unburnt natural red sienna. The No. 12 paint was composed of a body of natural unburnt ochre combined with 10 per cent. hydrated sulphate of lime and 2.4 per cent. tinting color. It will be seen from this analysis of the composition that the paint showing greatest durability was composed of natural unburnt ochre and a small amount of hydrated sulphate of lime. The most interesting feature of this paint, however, was the fact that 11.9 per cent. by weight of the pigment was water in combination with the clay and sulphate of lime, showing that the calcining of the pigment is not essential, and that water in stable chemical combination with the pigment does not cause rusting beneath the surface. The paint of least durability (No. 8) contained a relatively large proportion of hydrated sulphate of lime and was composed of well calcined material, the lack of durability in that case, however, being due to the physical condition of the pigment and not to its chemical composition. Experience has shown that although hydrated sulphate of lime is a good inert filler and that it can be reduced to a degree of fineness enabling it to pass any test, other materials equally inert and durable can be used as a filler with less milling, and hence at a lower cost.

Carrying out the investigation further by examining a number of commercial paints showed that the most finely divided of any of the materials examined was yellow ochre. Calcined red oxide has about the same degree of fineness as the body of the standard No. 8 paint. Carbonate of lime (whiting) is one of the finest body fillers, but cannot be used where the paint is exposed to acid fumes. Barium sulphate can be ground to a reasonable degree of fineness, much smaller than the finest hydrated sulphate of lime (Gypsum) obtainable.

The whole investigation resulted in the production of a new standard paint, known as No. 4, which is now used on structural steel on the Philadelphia & Reading. It consists of a natural uncalcined pigment tinted with a small proportion of black and ground in raw linseed oil in paste form. The fineness is even greater than the No. 12 paint heretofore used, and it has essentially the same composition.

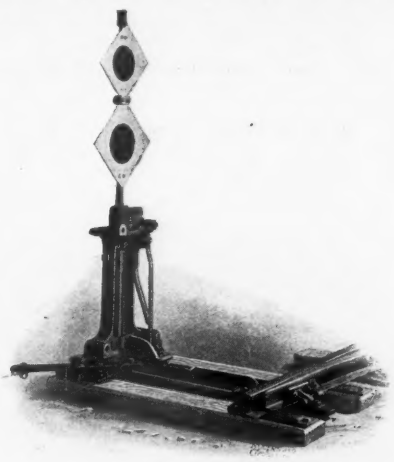


Fig. 1.—Main Track Position.

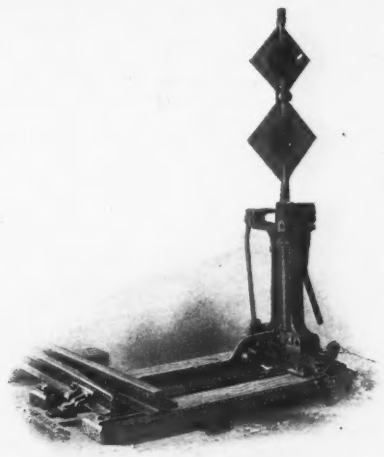


Fig. 2.—Side Track Position.

### The Hayes Lifting Derail.

The Cleveland, Cincinnati, Chicago & St. Louis is now using about 300 Hayes lifting derails, and the device appears to be finding favor elsewhere. Its first cost is low, the wear is inappreciable and favorable reports have been made concerning its behavior in snow. The Hayes Track Appliance Company, of Geneva, N. Y., has been formed to make and sell the device, Mr. S. W. Hayes, the inventor, being the president of the company.

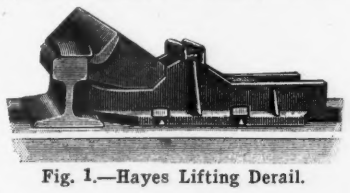


Fig. 1.—Hayes Lifting Derail.

This derailer consists of two malleable iron castings, which together weigh 105 lbs. When in position to derail its appearance is as shown in Fig. 1. The upper face of the block is shaped to turn a wheel upward and outward. The block slides, transversely to the track, in the guide box, Fig. 3, being kept kept in place by the two projections shown on the sides of the block in Fig. 2, which engage with the grooves on the inner surface of the sides of the guide box. The operating connection fastens directly to the moving piece, the lugs for which appear at the right in Fig. 2. The base of the derail is so shaped as to be fastened to two ties by spikes or lag screws. A wheel thrown off the track by this device falls clear of the whole apparatus and does it no harm.

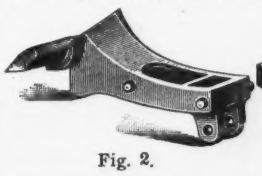


Fig. 2.

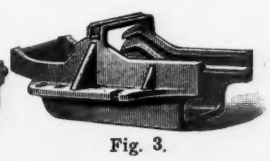


Fig. 3.

This derail was put in at a large number of places on the C., C., C. & St. L. and its behavior was observed a long time before it was patented, so that the inventor now says, with reason, that it is a tested device. Even during the severe snows of the present winter these derails have been kept in satisfactory condition without special attention from the sweepers. It does not require precise adjustment, as the block falls into its final position, either open or closed, by gravity.

A number of engineers and road masters who have used the device give it favorable testimonials. One of these says that in one case a derail in a side track on his line has come into service seven times, one of these cases being an engine, and the derail has not suffered the slightest damage. His yard men believe that it will never fail to derail anything that runs against it. The Pennsylvania and the Terminal Railroad Association of St. Louis are among the companies for which orders have recently been filled.

### Some New Types of Switch-Stands.

The accompanying engravings show a new type of switch-stand made by the Morden Frog & Crossing Works, Chicago. It is designed for use on facing-point switches and will operate a distant signal, facing-point lock and home signal, beside throwing the switch and interlocking all parts in a fixed position, all by means of a single lever or handle. It can be equipped with an automatic electric device for placing the stand and switch under the control of the telegraph operator at a station. Equipped in this way, the device is controlled by one man and operated by another, thus making doubly sure the discovery of any fault or defect. Fig. 1 shows the stand in main-track position and Fig. 2 shows it set for a siding.

This company has another new type which is an all-steel, non-breakable, low or ground-throw switch-stand. It is made from plate and forgings. Another new pattern is a four-way stand for the operation of movable-point slip switches. This has a positive action for each of the positions it governs, the handle being set in a controlling notch corresponding to a particular position. These stands will be on exhibition at the American Railway Engineering and Maintenance of Way Convention.

## TECHNICAL.

### Manufacturing and Business.

The Pencoyd Iron Works is being overhauled and will resume operation about April 1.

The Pennsylvania R. R. is in the market for machine tools to be used in its new car shops at Wilmington, Del.

The Buffalo Tool & Machine Co. is in the market for some wood-working machinery and machine tools to replace those lost in a recent fire.

The Turbine Motor Tool Co., of Chicago, has been incorporated by Wm. L. Hall and others, with a capital of $10,000, to make tools and machinery.

The Climax Railway Supply Company, Chicago, has received an order from the Illinois Central for four dozen Union drop-forged claw bars with extra claws.

The Bettendorf Axle Company has opened an office at 42 Broadway, New York. G. N. Caleb will represent the company in the East, with headquarters as above.

Paul Dickinson, Chicago, expects to exhibit a model of an entirely new smoke-jack at the American Railway Engineering and Maintenance of Way Association convention at Chicago.

The J. M. Ross, Sons & Co., Brampton, Ont., has been incorporated with a capital of $229,000, to make portable and traction engines. The directors are J. M. Ross, F. J. Ross, of Brampton, and others.

The Third Rail Safety Signal Co., of New York, has been incorporated with a capital of $25,000 to make electric railroad signals. The incorporators are George F. Valentine, Otto Ernst and A. P. Nevin.

The Monarch Machine Co., of New York City, has been incorporated in Delaware with a capital of $50,000, to make and sell machinery. The incorporators are Frank E. Field, F. D. Van Atla, of New York, and others.

The Knowles Engine & Machinery Co., Colorado Springs, Colo., has been incorporated with a capital stock of $300,000 to make the Knowles Rotary Engine. John Knowles is President and Manager and H. E. Woods Vice-President.

The stockholders of the Boston & Lockport Block Co., Lockport, N. Y., have voted to increase the board of directors by one and orders have been given to prepare plans for new shops and submit them to the directors at an early date. At a recent meeting of the directors the following officers were elected: A. D. Bosson, President; Frank Gebbie, Vice-President; Miron H. Tarbox, Treas-

urer, and A. B. Tarbox, Secretary. The latter was also elected as the new member of the board of directors.

The directors of the American Nut & Bolt Fastener Company, Pittsburg, Pa., have elected for the ensuing year the following officers: Milton Bartley, President and General Manager; Frederick Bowery, Vice-President; Barton Grubbs, Secretary and Treasurer, and John C. Bowery, Assistant Secretary and Treasurer. This company will have an exhibit of the "Bartley" fasteners at the convention of the American Railway Engineering and Maintenance of Way Association, at Chicago, March 15, 16 and 17, and also at the World's Fair at St. Louis, on six cars. This company now makes fasteners of 140 different designs. During the year 1903 "Bartley" fasteners were used on 18,000 cars. The Union Switch & Signal Company is making 20 crossings and frogs for a prominent railroad which will have the "Bartley" fastener.

### Iron and Steel.

The New Haven Iron & Steel Co., New Haven, Conn., has resumed work after a shut-down of about eight weeks.

A new steel mill is to be built at San Diego, Cal. W. E. Webb, of that city, and others have bought large iron property in Southern California.

The Cambria Steel Co. has resumed work in its Bessemer department at Johnstown, Pa., and has started two old-fashioned puddling furnaces on special orders.

At the annual meeting of the Railway Steel-Spring Co. a dividend of 2 per cent. was declared on the common stock, payable April 4. This is the first dividend on the common stock since the organization of the company. The retiring board of directors was re-elected with the exception of F. D. Smith, who was succeeded by M. R. Parker. The balance sheet submitted to the stockholders shows an increase in surplus of $802,097, as compared with December, 1902.

### A Government Cement Works.

The Interior Department has rejected all the bids recently submitted for furnishing cement for the Tonto Basin Dam, in Arizona, and will buy machinery to cost about $50,000 with which to equip a Government plant at a total cost of about $100,000, to make the necessary material near the Tonto Basin.

### Suit Against Standard Steel Car Company Dismissed.

The long pending suit of the Pressed Steel Car Company against the Standard Steel Car Company and John M. Hansen, its President, to recover possession of certain drawings and patent rights for steel cars which, it was alleged, had been fraudulently appropriated by the defendant at the time he severed his connection with the plaintiff as Chief Engineer and organized the defendant company, was dismissed in the United States Circuit Court at Pittsburg, on Monday, March 7, Judge Joseph Buffington rendering the decision. The Pressed Steel Car Company was ordered to pay the costs. A number of other suits against the Standard Company for infringement of patents are still pending. The higher courts may be appealed to by the plaintiffs in connection with Judge Buffington's decision.

### Insulated Rail-Joint Patents.

The Weber Railway Joint Mfg. Co. announces that in the litigation between itself and George L. Hall (the G. L. H. Rail Joint Company), concerning patents for insulated rail joints, the Patent Office and the Circuit Court of the United States have both rendered decisions confirming the Weber claims. In an interference between Mr. George A. Weber and Mr. Hall, in which the sole question was, who made the invention, the Patent Office awarded priority of invention to Mr. Weber and granted to the Weber Company Patent No. 738,862, Sept. 15, 1903. In the suit of the G. L. H. Rail Joint Company for infringement of Hall's patent of July 22, 1902, the Circuit Court rendered a decree Feb. 23, 1904, adjudging claims 1 and 2 of Hall's patent to be void and dismissing the complaint, with costs in favor of the Weber Company.

### Track Troubles in the Simplon Tunnel.

One of the engineers of the Simplon relates some particulars of the obstacles recently met. At one point in the north end more than five miles from the entrance, the pressure caused the floor of the tunnel to rise some 20 in., and it was necessary to arch the bottom to hold it down. Then the temperature of the rock rose to 122 deg., and in places reached 143 deg. This is reduced by spraying with cold water. One warm spring was struck which they succeeded in closing; but a little further on another was tapped with a temperature varying from 122 deg. to 140 deg. This is beyond the central point, and where the tunnel inclines away from the entrance. The consequence is that the water covers the bottom of the tunnel back to the divide and scalds the feet of the workmen. Work had to be abandoned until provision could be made for pumping the water up and draining it by the side gallery, a work not completed at last accounts.

### Tube Railroad Precautions.

Some months ago the British Board of Trade railroad officials conferred with the engineers of the London electric tube lines then operating or building, with regard to the adoption of the utmost precautions for public safety. It is understood that although differences of opinion have necessarily arisen in certain details, a set of precautions is being drawn up which will doubtless be complied with, but the exact nature of these precautions has not been made public. It may be interesting in this connection to mention that the Central London Railway has been holding large sums of money unpledged or undivided during the last two or three half years and these accumulations now figure in the neighborhood of £60,000, independent of ordinary reserves. Sir Henry Oakley, the chairman, told his shareholders that this balance was so held available because they did not yet know what recommendations might be made by the Royal Commission on London Traffic when it completed its sittings.

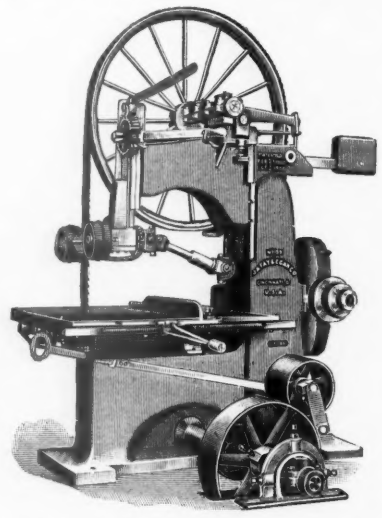
It was expected that the Great Northern & City would be opened to the public on Feb. 8 or 9, but as Col. Yorke, after his second inspection on Feb. 6, required still further alterations to be made in the signaling arrangements, a further delay was occasioned.

### Mr. George Westinghouse on Electric Railroad Traction.

In his speech at the annual meeting of stockholders in the British Westinghouse Electric & Manufacturing Company, in London, on Feb. 5, Mr. George Westinghouse had a good deal to say about railroad electrification prospects and he entered in some detail into the effect of the introduction of the Lamme and other single phase alternating motors into this branch of service. He said that by dispensing with costly substations and their equipments, not only was the first cost of installation reduced, but the saving in cost of operation would be equal to the interest on from 20 to 30 per cent. of the aggregate capital expenditure required to instal a complete system. He in a measure justified steam railroad officials for their caution in dealing with the question of electrical working, by saying: "In view of the development of a cheaper, safer and better system of electrical distribution for railroad operations, and as a result of accidents, of a further realization of some of the dangers to be avoided in the installation of power plants and in the application of apparatus to railroad vehicles, it may not prove to be a matter of regret that the time already taken for the work in progress by the several railroads has greatly exceeded expectations."

### An Automatic Band Rip-Saw.

The saw shown herewith is designed especially for heavy work, and is particularly recommended to the car builder, the mill owner, makers of farm machinery and to other wood workers who have stock that requires heavy framing. It is safe to operate, a very small kerf is removed, wide or thick material is easily ripped, little power is required, the table is always at standard height, the rolls are close



together, allowing short pieces to be easily fed, and the adjustment of fences and rolls is quickly made. It is admirably adapted to reducing large timbers to smaller dimensions, ripping wide lumber into strips of varying widths, resawing from the side of a timber, and other light work. The straining device, which controls the upper wheel and the path of the saw blade on the face of the wheels, is new and very sensitive. The strain takes up the slack in the blade instantly. The lower wheel is solid, lessening the circulation of dust and giving increased momentum so that its speed governs the upper wheel and prevents it from overrunning the lower wheel. The machine has three feeds and powerfully-driven feed rolls in and above the table. By a single movement of a lever the machine can be instantly changed to a hand-feed rip saw or the feed can be stopped. The machine is made by J. A. Fay & Egan Company, Cincinnati, Ohio.

### A New Cement Plant for the Illinois Steel Company.

The Illinois Steel Company in 1896 undertook an extensive series of experiments with a view to making from blast-furnace slag a true Portland cement that would compete in every respect with the best brands of foreign and American Portlands. These experiments were so successful that in 1900 a cement plant was completed at the works of the company at South Chicago at a cost of $500,000. This plant produces 1,500 barrels a day of Universal Portland cement, which, as its name implies, is suitable for all purposes. This is a true Portland cement, its method of manufacture, chemical composition, fineness and specific gravity being in accordance with the definitions of the most prominent cement authorities in the United States and Europe. On account of the artificial character of the process employed the mixtures are under complete control and entire uniformity is obtained in the finished product. Universal Portland cement is used extensively by almost all the railroads entering Chicago.

The Illinois Steel Company is now erecting near South Chicago the Buffington cement plant at a cost of $1,500,000, to have a capacity of 4,500 barrels of cement a day. In this plant the power will consist entirely of electric motors. There will be 16 kilns, 80 ft. long and 7 ft. in diameter. It is expected to have the plant running in July, 1904, giving the cement department of the Illinois Steel Company an annual output of 2,000,000 barrels of Universal Portland cement.

## THE SCRAP HEAP.

### Notes.

The Reading Coal & Iron Company has more than 2,000 cars of coal in and near Philadelphia awaiting shipment to points in New England. This congestion is due to a lack of barges to remove it.

At Columbus, Ohio, the Pennsylvania has bought a large dwelling house, near its yards, which is to be fitted up as a lodging house and restaurant for trainmen. It is to have a lunch counter, reading rooms and bath rooms.

The Nashville, Chattanooga & St. Louis has just finished the erection of new semaphore train order signals at both stations on its Chattanooga Division, 151 miles. Arms for both directions are fixed to the same post. The Nashville Division and the Western & Atlantic, 304 miles, are also to be equipped with these double arm signals.

The Chicago reporters say that the Omaha grain rate war is still active. The latest news which they give us is that the Chicago & North Western has made a reduction in the rates from interior Nebraska points to the Mississippi River. The rate war on sugar in car loads has been extended to the Gulf of Mexico, the Illinois Central having announced a rate of 20 cents from New Orleans to Missouri River points. The Missouri Pacific announces a reduction of 10 cents (from 40 to 30) in the rate on sugar from New York by Mallory's steamers to Galveston and thence by rail.

The employees of the Great Northern Railway who wear uniforms must hereafter have the garments made by a single firm in St. Paul, with which the company has made a contract. Passenger and dining car conductors and ticket exchangers will hereafter wear brown duck vests between July 1 and Sept. 1. All uniformed employees must wear white linen, with black neckties, and no employee will be considered fully uniformed if he wears a flannel shirt, colored linen or colored neckties. The shoes must be of black leather, well polished, and employees must be clean shaven or have beards neatly trimmed. The wearing of gaudy or heavy watch chains or jewelry will in no case be permitted. The use of tobacco and the carrying of toothpicks will not be permitted. Uniform suits are to be worn by conductors, passenger and dining and sleeping-car ticket exchangers, passenger brakemen, news agents, sleeping-car porters, parlor and train porters and agents. The agents' uniform will consist only of a cap with the word "agent" in silver letters across the front.

The National Wholesale Lumber Dealers' Association, which has been holding its annual convention at Washington, D. C., proposes to establish a transportation bureau. This action is reported as being taken on the recommendation of the committee on railroads, who based their conclusion on what they had learned about complaints of insufficient supply of cars, delay in delivery of carloads, excessive weights and overcharges as the result of alleged carelessness of the railroads, delay caused by methods of adjusting over-charge claims, unwarranted demurrage charges and lack of uniformity of rates. At a supper which followed the convention an address was made by Secretary Cortelyou, of the Department of Commerce and Labor, who said, among other things:

"In spite of the rapid rate at which our forests have been diminishing for the last three decades, the national lumber supply is still in such a state as to constitute one of the several fundamental elements of our commercial superiority over competing nations in the world's markets. Lumbering still ranks fourth among our great industries. The problem of problems increasingly tends to become, how to conserve the existing stores of natural resources in such a way as to supply present demands without impairing the foundations of our economic position.

"The inadequacy of transportation facilities has been a standing complaint among lumbermen, engendering much friction between transportation interests on the one hand and shippers and receivers of lumber on the other. Such questions can usually be settled rightly only by having light on the subject, and an impartial inquiry into the conditions would no doubt go far toward an improvement. Unsatisfactory commercial conditions should not be left to remedy themselves when public inquiry might facilitate the substitution of better methods."

### Nicaragua Government Railroads.

The Government of Nicaragua has leased the national railroads of Nicaragua, including repair shops, buildings, stations, rolling stock, etc., for ten years from Jan. 1, 1904, with the privilege of renewal, to Julio Wiest, of Managua, Nicaragua. Ten per cent. of the gross income is to be applied to repairs, improvements, etc.; 25 per cent. turned over to the Government as rental, and 65 per cent. to cover running expenses, contractors' profits, etc. During the time of the contract the lessee will have the preference on any new line of railroad that the Government may desire to build; but he will not be allowed to transfer or sublet the road to any persons or companies not acceptable to the Government, nor, under any circumstances, to a foreign government. Our authority is the Consul at Managua, Nicaragua.

**Dublin Trolley Roads.**

The Dublin United Tramways Co., which operates 47 miles of double-track trolley road, had a record year in 1903. The visit of King Edward and the accompanying festivities increased the traffic receipts by over $20,000. The company has a well-organized system of parcels traffic which also brought in close upon $15,000. This section of the Dublin service has lately been inquired into by deputations from many large cities in England which are about to move in the direction of luggage conveyance as an aid to their trolley lines. With its modern power-station equipment, the Dublin engineering staff has now got down to the very lowest possible figure in cost of electricity. The output is 7½ million units per annum, and last year it cost only .438 of a penny to propel a car for one mile.

**"First Aid to the Injured" on the Pennsylvania.**

An order has been issued by the General Manager of the Pennsylvania Railroad providing for lectures to employees on first aid to the injured, and for maintaining "first aid boxes" of emergency surgical appliances at the principal stations and on the trains. Stretchers will be carried on baggage cars and wrecking cars, and also will be kept at the principal stations and yard offices. The box and its contents and the stretcher are made and fitted up according to a standard recommended by the Relief Department. The order seems to indicate that first aid boxes will be carried on locomotives but not in cars. The box is made of tin and is enclosed within a wooden box, both being sealed; a regular inspection is to be provided, so that when the seal is broken the contents of the box will be replenished if necessary. Boxes are to be sent out from the Altoona shops, and all replenishing is to be done there. The lectures to employees are to be given by the medical examiners of the Relief Department. Besides trainmen of all classes, instruction will be given to yard masters, and their assistants, shop foremen and assistant foremen, and maintenance of way foremen.

**Refreshingly Direct.**

Vice-President Walker D. Hines, of the Louisville & Nashville, has published a letter addressed "to the people of Alabama," in which he says: Would you think it fair and just if the lawyer who appeared in court and argued a case against you should be called to sit as the judge in that same case at the next term of court? Last June Mr. B. B. Comer appeared before the Railroad Commission of Alabama and argued vigorously that all railroad rates in Alabama should be reduced. As candidate for president of the Railroad Commission he is now promising to decide all those matters against the railroad companies. His various lines of business give him a direct and very large interest in a great many of the most important matters. The people of Alabama would not elect any man as President of the Railroad Commission who had appeared in behalf of the railroads; should they in justice elect a man who appeared against the railroads? The law declares that a judge must not act in a case in which he has been attorney or in which he is interested. Does not the same spirit of fairness require that a man should not be elected President of the Commission for the express purpose of deciding matters in which he is interested both personally and as attorney?

## MEETINGS AND ANNOUNCEMENTS.

*(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page 16.)*

**Franklin Institute.**

A stated meeting of the Sections was held in Philadelphia, March 10. The programme included a paper on "Fuel Gas," by Hawley Pettibone, of New York.

**Central Railway Club.**

At the meeting of this Club, to be held at the Hotel Iroquois, in Buffalo, March 11, papers will be read on Application of Equalizing Car Springs, by G. N. Dow, and the Location of Tanks in Oil Houses, by Laurence N. Jackson.

**The Rocky Mountain Railway Club.**

The regular monthly meeting of this Club was held in the Union Depot, Denver, March 8. The discussion of Mr. Hedendahl's paper, "Brake Control of Heavy Capacity Cars on Grade," was continued, and a paper by J. S. Ferguson on "Chilled Cast-Iron Car Wheels" was discussed.

**St. Louis Railway Club.**

In lieu of the regular March meeting a trip by special trolley to the World's Fair and by special train service through the grounds has been arranged. The trip will be made on Saturday, the 12th, instead of the regular meeting day, leaving Fourth and Olive streets at 2 p. m. Exposition officers are to talk on matters of interest to railroad men, and there will also be a short paper by F. W. Johann.

## PERSONAL.

—Mr. Gideon H. Candee, at one time President of the Dubuque & Dakota, now a part of the Chicago Great Western, died at his home in Lowell, Mass., on March 2, at the age of 72. Mr. Candee's early railroad service was on the New York, Providence & Boston. He served in the engineering department of the Pittsburg, Fort Wayne & Chicago and the Illinois Central, and in 1880 went to the Dubuque & Dakota. In 1881 he was promoted to be Vice-President of this company, and in 1883 was elected President.

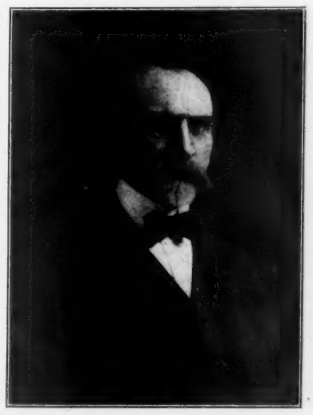
—Mr. George W. Boyd, General Passenger Agent of the Pennsylvania Railroad, has received from the German Emperor, through the ambassador at Washington, the badge of the decoration of the Order of the Crown, in remembrance of services rendered to Prince Henry of Prussia on his recent visit to this country. The badge is a white enameled gold Maltese Cross.

—Mr. T. W. Crowley, the new Superintendent of Telegraph of the Delaware & Hudson, is 35 years old. He began his railroad service in 1883 as an operator on the Erie Railroad. In November, 1889, he was promoted to be train despatcher on the Allegheny Division, and from then until 1903 he was successively Train Despatcher, Chief Train Despatcher and Trainmaster.

—Mr. Edward M. Shepard, who has just been appointed Special Counsel in New York of the Pennsylvania Railroad and Special Advisory Counsel of the Long Island Railroad, is the son of Lorenzo B. Shepard, who was one of the leading lawyers of his time and the youngest delegate to the New York Constitutional Convention of 1846, in which he took a prominent part. Edward M. Shepard graduated from the College of the City of New York in 1869. The thorough training that college has always given, especially on its scientific side, furnished him with an equipment of which he was not slow to avail himself. He studied law with John E. Parsons, whose partner he afterwards became. Mr. Parsons' critics would say that his mind was like a Rogers' knife blade, keen and well tempered, but not even. Certainly no one can deny that a more acute and vigorous mind than his never took part in the contests of the New York bar. In the many years that he and Mr. Shepard were together their practice covered a wide field, but especially that of railroad and corporation law. Nevertheless Mr. Shepard felt the obligation of citizenship more strongly than do many of our leading lawyers. He has always been a student of politics and social science and has broadened and liberalized his naturally keen and active mind by taking leading part in the movements for civil service, tariff and municipal reform which have done so much to give this country more honest and efficient government, both national and civic. He was chairman of the Civil Service Commission, a member of the State Forestry Commission (and as such first drew the Adirondack Forest Reserve legislation), and was Democratic candidate for Mayor of Greater New York in 1901. When Mr. Beekman was elected to the Supreme Court in 1895 Mr. Shepard succeeded him as Counsel to the New York Rapid Transit Commission. He drew the elaborate contract under which the subway is being constructed. It is a masterpiece, providing with foresight and good judgment for our greatest municipal engineering work. He has untiring industry, undaunted courage, absolute integrity and a ready and resourceful mind.

—Mr. W. R. Page, a Director of the Grand Canyon Railroad, died at his home in Proctor, Vt., February 27, at the age of 54.

—Mr. William F. Potter, whose promotion to the office of Vice-President and General Manager of the Long Island Railroad is announced, is a native of Utica, N. Y., born there in 1855. Mr. Potter was educated at Worcester, Mass., and after a military and technical training, he visited Germany and France. In 1875 he began his railroad work as a clerk in the Auditor's office of the Flint & Pere Marquette, from which he was later transferred to the Treasurer's office. From this latter position Mr. Potter went into the train service, where he steadily rose. He was Freight Conductor and then successively Passenger Conductor, Station Master, Division Superintendent, Assistant General Superintendent and General Superintendent, being promoted to the last-named position in 1891. His service on the Long Island began in 1897, when he was appointed General Superintendent. Mr. Potter represents his company as a member of the Atlantic Avenue Improvement Commission and of the Brooklyn Grade Crossing Commission. Mr. Potter is also a Director of a large number of companies subsidiary to the Long Island.



—Mr. A. S. Jennings, at one time Auditor of the Gulf, Colorado & Santa Fe, died at Los Angeles, Cal., recently. Mr. Jennings resigned his position some months ago, owing to ill health, and at that time went to California.

## ELECTIONS AND APPOINTMENTS.

*Bangor & Aroostook.*—C. C. Brown has been appointed General Passenger Agent, with headquarters at Bangor, Me. The office of Traffic Manager has been abolished.

*Buffalo, Bradford & Kane.*—A. B. Campbell has been appointed General Superintendent, with headquarters at Bradford, Pa.

*Central of Georgia.*—W. E. Chester, hitherto Master Mechanic, has been appointed General Master Mechanic, with headquarters at Savannah, Ga., and W. H. Fetner, hitherto Foreman of Machine Shops, has been appointed to succeed Mr. Chester as Master Mechanic at Macon, Ga.

*Central of New Jersey.*—B. P. Flory has been appointed Mechanical Engineer, succeeding G. W. Wildin, resigned.

*Chicago, Rock Island & Pacific.*—The headquarters of H. E. Byram, General Superintendent of the South Western District, has been removed from Topeka, Kan., to Kansas City, Mo.

A. S. Zinn has been appointed Division Engineer of the Oklahoma Division.

*Chicago, St. Paul, Minneapolis & Omaha.*—G. L. Ossmann has been appointed Car Service Agent, with office at St. Paul, Minn., succeeding A. Drezmal.

*Dayton, Lebanon & Cincinnati.*—G. F. Mansell has been appointed General Auditor, with headquarters at Columbus, Ohio, succeeding F. E. Wilkin, resigned.

*Denver & Rio Grande.*—The headquarters of W. J. Donovan, Superintendent of the Second Division, have been removed from Salida, Colo., to Minturn.

*Florence & Cripple Creek.*—J. H. Waters, General Manager, has been elected President, also.

*Genesee & Wyoming.*—H. C. Finch has been appointed General Manager and A. J. Wallace Auditor, both with headquarters at Retsof, N. Y.

*Gulf & Ship Island.*—P. M. Seay, hitherto Chief Despatcher, has been appointed General Superintendent, with headquarters at Gulfport, Miss., succeeding Richard Morgan, resigned.

*Illinois Central.*—G. H. Groce has been appointed Superintendent of Telegraph, with headquarters at Chicago, Ill., succeeding G. M. Dugan, who has been appointed Assistant Superintendent of Telegraph.

*Lake Erie & Detroit River.*—See Pere Marquette.

*Long Island.*—At a meeting of the Board of Directors, held recently, W. F. Potter was elected a Director and Vice-President. At the same meeting he was chosen General Manager, and C. L. Addison, hitherto Superintendent of Transportation, has been appointed General Superintendent, to succeed Mr. Potter, and Mr. Addison in turn is succeeded by F. Hartenstien, who was formerly Freight Trainmaster at Jamaica, N. Y. Edward M. Shepard has been appointed Special Advisory Counsel. (See Pennsylvania.)

*Macon, Dublin & Savannah.*—E. E. Williamson, Traffic Manager, with headquarters at Macon, Ga., has resigned. H. K. Deale, Assistant General Freight and Passenger Agent, with headquarters at Savannah, Ga., has resigned.

*Mexican Central.*—On and after March 15, the offices of the President, the Vice-President and General Counsel, the Vice-President and Comptroller, the Treasurer, the Transfer Agent and the Purchasing Agent, now in St. Louis, Mo., will be transferred to No. 25 Broad street, New York City.

*Midland Terminal.*—J. H. Waters has been elected President, with office at Denver, Colo., in addition to his office of General Manager, with headquarters at Cripple Creek, Colo.

*National of Tehuantepec.*—J. N. Galbraith, hitherto Assistant General Manager of the National of Mexico, has been appointed General Manager of the N. of T., with headquarters at Rincon, Antonio, Mex.

*National Railroad of Mexico.*—A. Clark, hitherto Superintendent of the Northern Division, has been appointed Assistant General Manager, with headquarters at Mexico, Mex., succeeding J. N. Galbraith, resigned.

*New Orleans Terminal Company.*—G. McD. Nathan has been appointed Acting General Freight Agent, with headquarters at New Orleans, La.

*Norfolk & Western.*—V. A. Riton has been appointed Superintendent of the Shenandoah Division, with headquarters at Roanoke, Va., succeeding Geo. P. Johnson.

*Pennsylvania.*—Edward M. Shepard has been appointed Special Counsel in New York, to perform such legal duties as may from time to time be assigned to him.

*Pere Marquette.*—W. Woollatt hitherto General Superintendent of the Lake Erie & Detroit River, has been appointed Superintendent of the Buffalo Division of the P. M.

*Philadelphia & Reading.*—C. Graham has been appointed Master Mechanic in charge of the Motive Power Shops and Engine Houses on the Reading and Lebanon Divisions outside of Reading, with headquarters at Reading, Pa. Mr. Graham will continue to be in charge of the Port Richmond Shops.

*Southern.*—P. L. McManus has been appointed Assistant Superintendent, with headquarters at Charlotte, N. C.

*Toledo, St. Louis & Western.*—George H. Ross has been appointed General Traffic Manager, with headquarters at Toledo, Ohio, succeeding C. D. Whitney, resigned.

*Washington County.*—The following officers of the Maine Central have been appointed to the same positions on the Washington County: T. L. Dunn, Chief Engineer; F. E. Boothby, General Passenger Agent, and W. K. Sanderson, General Freight Agent. All with offices at Portland, Me.

H. F. Burpee and N. P. Baker retain their headquarters at Calais. Mr. Burpee will be Assistant General Passenger and Freight Agent and Mr. Baker will be Superintendent.

*West Side Belt.*—H. J. Lawrence has been elected Second Vice-President.

## LOCOMOTIVE BUILDING.

*The Chicago, Milwaukee & St. Paul* is building 10 consolidation (2-8-0) locomotives at its own shops. These locomotives will weigh 177,000 lbs., with 156,400 lbs. on the drivers; cylinders, 22 in. x 28 in.; boiler pressure, 200 lbs.; heating surface, 2608.65 sq. ft.; 321 tubes,

2 in. in diameter and 14 ft. 6 in. long; fire-box, 9 ft. 3⅜ in. long and 5 ft. 5¾ in. wide and grate area, 47.45 sq. ft.

*The Vandalia* has ordered 15 simple six-wheel switching engines and 14 mogul (2-6-0) locomotives from the American Locomotive Co. for May, 1904, delivery. The switching engines will weigh 144,000 lbs.; cylinders 20 in. x 26 in.; diameter of drivers, 51 in.; straight boiler with a working steam pressure of 180 lbs.; heating surface, 1,955 sq. ft.; 311 Pennsylvania Railroad specification tubes 2 in. in diameter; fire-box, 108 3/16 in. long, 41¾ in. wide; grate area, 31 sq. ft.; tank capacity, 5,000 gals. of water, and coal capacity 15,000 lbs. The mogul locomotives will weigh 182,500 lbs., with 156,500 on drivers; cylinders, 21 in. x 28 in.; diameter of drivers, 63 in.; straight boiler with a working steam pressure of 200 lbs.; heating surface, 2,935 sq. ft.; 390 Pennsylvania Railroad specification tubes 2 in. in diameter and 161⅞ in. long. Pennsylvania Railroad specifications, wide; fire-box, 108⅛ in. long and 69¼ in. wide; grate area, 52 sq. ft.; tank capacity, 7,500 gals. of water, and coal capacity, 23,000 lbs.

## CAR BUILDING.

*The Louisiana & Northwest* has ordered four cabooses from the Mount Vernon Car Mfg. Co.

*The San Pedro, Los Angeles & Salt Lake* has ordered 50 Ingoldsby automatic dump cars of 80,000 lbs. capacity from the Mount Vernon Car Mfg. Co.

*The St. Louis & San Francisco* denies being in the market for 20 passenger coaches at the present time, as reported in our issue of March 4th.

*The Potosi & Roi Verde* has ordered 30 flat cars from the Mount Vernon Car Mfg. Co. This order was incorrectly stated in our issue of March 4th.

*The Pennsylvania Lines West* are asking bids on 700 class XL box cars, 700 class GL self-clearing hopper gondolas, 300 class Xf stock cars, 300 class Gsa gondolas and 80 class Fm flat cars.

*The Mount Vernon Car Mfg. Co.* has received the following orders: Sun Bros. Shows, three 60-ft. flat cars and one 60-ft. stock car; Frank Adams Southern Railroad Shows, one combination stock and flat car; Signior Santelle's Shows, two 60-ft. flat cars.

*The Grand Trunk* has ordered for the Detroit & Toledo Shore Line six cabooses from the American Car & Foundry Co. The cabooses will be 29 ft. long, 9 ft. wide, over end sills; and 10 ft. 10½ in. high, from rail to eaves. The special equipment includes: Miner tandem draft rigging and Fletcher journal box lids.

*The Chicago, Milwaukee & St. Paul* will build 500 box cars of 80,000 lbs. capacity at its Milwaukee shops. The cars will be 40 ft. long, 8 ft. 6 in. wide and 8 ft. high, all inside measurements. The special equipment will include: Congdon brake shoes, security doors, Hennessey double friction draft rigging, pressed steel journal box lids, C. M. & St. P. standard paint, Chicago-Cleveland roofs, Barber four-wheel trucks and C. M. & St. P. wheels.

## BRIDGE BUILDING.

Cincinnati, Ohio.—The bids opened Feb. 27 by the County Commissioners, for building the superstructure of the Elizabethtown Bridge, were as follows: Indiana Bridge Co., $115,500; Attica Bridge Co., $116,000; Mt. Vernon Bridge Co., $127,000; Virginia Bridge Co., $120,200 and $118,000; Canton Bridge Co., $137,000; King Bridge Co., $121,500 and $126,000; Cincinnati Bridge Co., $94,000; Bellefontaine Bridge Co., $112,000; Huston & Cleveland Bridge Co., $138,000; Walton Iron Co., $130,000 and $125,000; Buckeye Bridge Co., $117,000; Brackett Bridge Co., $119,500; Chattanooga Bridge Co., $114,600; Penn Bridge Co., $130,000; Champion Bridge Co., $74,000; R. R. Moorman & Co., $114,000; New Jersey Bridge Co., $140,000; Berlin Construction Co., $160,000.

Conconully, Wash.—A bridge will be built at Pateros 295 ft. long over the Methow River; also a bridge 340 ft. long at Riverside.

Ellenville, N. Y.—Bids will soon be asked for building an iron bridge over Beerkill Stream.

Eudora, Kan.—Douglas and Leavenworth counties will build a bridge over the Kaw River at Eudora, to cost about $30,000.

Fort Wayne, Ind.—A new iron bridge will be built during the summer over the Auglaze River, near Cloverdale, on the Fort Wayne branch of the Chicago, Hamilton & Dayton.

Gilbertsville, Ky.—On March 5 the United States Senate passed the bill authorizing the Chicago, St. Louis & New Orleans R. R. Co. (Illinois Central) to build a bridge over the Tennessee River, near Gilbertsville, Ky. (Feb. 26, p. 151.)

Grove, I. T.—The Grove Bridge Co. has been organized to build a steel wagon bridge over Grand River, near this place, to cost about $30,000.

Moravia, Pa.—A new bridge is to be built by the State at Moravia, to cost about $25,000.

Morganton, N. C.—Burke County will soon build two bridges over Catawba River, one at Bridgeton, and one at Hoffman's Crossing.

Newark, N. J.—Residents are petitioning for a bridge to be built over the Passaic River at Delevan avenue, Woodside. Engineer Owen, of Essex County, is estimating the cost.

Santa Fe, N. Mex.—Bids are wanted, April 4, by the Board of County Commissioners, for building a bridge over Santa Fe River and one over Calisteo River, near Cerrillos. A. L. Kendall is Chairman of the Commissioners.

Springfield, Ohio.—The County Commissioners will build a bridge over Mad River near Tremont; also one near New Carlisle.

Waterloo, Ind.—Petition is being made for building a bridge over White River on Merfield road, to cost about $50,000.

### Other Structures.

La Junta, Colo.—Bids are wanted about April 15 by C. A. Morse, Chief Engineer, Atchison, Topeka & Santa Fe R. R., Topeka, Kan., for building a steel and brick machine shop, 154 ft. x 398 ft., and a steel and brick blacksmith shop, 80 ft. x 150 ft.; also a power house, store house and factory, for which the foundations are complete. The total cost of the work will be about $250,000.

New York, N. Y.—Bids are wanted for building the underground station at Atlantic and Flatbush avenues of the Long Island Railroad, Brooklyn.

Saginaw, Mich.—The Pere Marquette, it is reported, will build a large freight house on the west side of the river, north of Genesee avenue.

St. Joseph, Mo.—The Chicago, Burlington & Quincy shops at St. Joseph, Mo., were damaged by fire, March 1, at a loss of about $25,000.

Washington, Ill.—The Toledo, Peoria & Western will build a brick and stone passenger station at this place.

Waynesboro, Pa.—The Landis Machine Co. will soon let a contract for building a large blacksmith shop at their works.

Yankton, S. Dak.—The Chicago, Milwaukee & St. Paul will build a brick or stone passenger station at Douglas avenue and Seventh street, to cost about $25,000, this spring.

Youngstown, Ohio.—The Youngstown & Southern R. R. Co. will build a large car house and machine shop on a site recently bought near Youngstown. The company will also build a large power station near Lisbon, Ohio.

## RAILROAD CONSTRUCTION.

### New Incorporations, Surveys, Etc.

Atchison, Topeka & Santa Fe.—Contracts are reported let for reballasting the Southern Kansas branch of this road from Ottawa, Kan., south to Cherryvale, 90 miles.

California & Oregon Coast.—An officer writes that contracts for grading this road from Grant's Pass, Ore., southwest through Wilderville and Kerby to Crescent City, Cal., 91 miles, will be let about May 1. The work is heavy, with a maximum grade of 2 per cent. and a maximum curvature of 12 degrees. There will be no steel bridges, but the work will include five tunnels ranging from 250 ft. to 3,200 ft. in length. There will be two branches from the main line—one via Smith River to Chetco, Ore., and the other via Requa to Redwood. T. W. M. Dreyer, 230 Montgomery street, San Francisco, Cal., is Chief Engineer. James B. Gunn is President. (Jan. 29, p. 88.)

Canada Southern (Michigan Central).—The directors of this company have voted to double-track the line between Buffalo and St. Thomas. Work will be begun as soon as the weather permits.

Central Ontario.—Surveys are reported in progress for an extension of this road from its present terminus at Bancroft, Ont., northwest to Whitney, 40 miles. Connection will be made with the Canada Atlantic at the latter point.

Chicago, Cincinnati & Louisville.—This road has been extended from Cottage Grove, Ind., east to Cincinnati, Ohio, 45 miles, and from Beatrice, Ind., west to Griffith, five miles.

Colorado & Southern.—Press reports states that preliminary surveys have been finished for a branch line from Bellville, Colo., to quarries near Owl Canon, 18 miles northwest of Fort Collins. It is reported that work will shortly be begun.

Council Bluffs, Tabor & Southern (Electric).—A franchise has been granted this company to build an electric railroad from Council Bluffs, Ia., through Glenwood, Tabor, Sidney, Riverton and Lockport to Tarkio, Mo., 84 miles. Rights of way are now being secured.

Dublin & Southwestern.—Work is reported in progress on this new line in Georgia from Dublin southwest through Eastman to Abbeville, 45 miles. E. P. Dentz, Dublin, Ga., is interested. (Feb. 19, p. 136.)

Fairfield R. R.—An application for a charter has been made by this company in South Carolina. It is proposed to build from Rockton to Alston, S. C., 20 miles. B. R. Heyward, Rion, S. C., is interested.

James Bay.—Surveys have been completed for this projected road from Toronto, Ont., to Sudbury, 260 miles. MacKenzie & Mann have the charter, and subsidies have already been granted by the Dominion and Ontario Parliaments. It is stated that work will be begun early in the spring.

Lake Superior, Long Lake & Albany River.—Surveys have been completed for 30 miles of this proposed railroad, from Peninsula Harbor, Ont., towards Albany River. The remainder of the line is now being located and it is stated that track laying will be begun early in the spring. H. DeQ. Sewell, Toronto, is Chief Engineer.

Luxora, Evening Shade & Northwestern.—It is reported that this company has awarded a contract for grading the first ten miles of its road to H. P. Liston, of Luxora, Kan. The road is projected to run through Mississippi, Craighead and Sharp counties, all in Arkansas. J. B. Driver, Luxora, is President, and M. W. Connelly is Secretary. (Feb. 5, p. 104.)

Marshall, Timpson & Sabine Pass.—It is reported that this company will soon begin work on an extension from Timpson, Texas, east to Center, 15 miles. Connection will be made with the Atchison, Topeka & Santa Fe's new extension at Center. C. M. D. Grisby, Longview Junction, Texas, is President.

Memphis & Gulf.—The contracts for building this road from Grenada, Miss., southeast through Meridian to Pensacola, Fla., about 300 miles, will be let within the next 30 days. H. P. Farrar, Memphis, Tenn., will be in charge of the work. (Feb. 19, p. 136.)

Nacogdoches Southeastern.—An officer writes that the contract for building this line has been let to Charles McSweeny, Houston, Texas. The proposed route is from Nacogdoches to a point on the Atoyac River, 30 miles. Grading has been begun, but no track has as yet been laid. E. B. Hayward, Davenport, Iowa, is President and W. H. Kimball, Nacogdoches, Texas, is Chief Engineer (Feb. 26, p. 152.)

Oklahoma, Roswell & White Mountains.—This company has been organized in Oklahoma to build a railroad from Mangum, Okla. T., to Roswell, N. Mex., approximately 400 miles. Surveying parties will be placed in the field at once. J. W. Graves, Oklahoma City, is President, and S. A. Byers is Secretary.

Ozark & Cherokee Central.—Press reports state that a contract has been awarded to Johnson Bros. for building the extension of this road from Okmulgee, Ind. T., to Shawnee, Okla. T., 75 miles. (Jan. 29, p. 88.)

Pennsylvania.—According to newspaper reports, this company will soon begin work on an elevated freight line designed to relieve the freight congestion in Pittsburg and on a large number of warehouses. The real estate for these projects is reported purchased and the Pittsburg Council has passed the ordinance permitting the building of the elevated line. Plans for this latter work have been prepared.

Rocklidge & Southern.—Incorporation has been granted this company in Ohio to build from a point on the Hocking Valley, at Rocklidge, Fairfield County, Ohio, south through Vinton, Jackson and Scioto counties to Portsmouth, 65 miles. G. M. Merritt, C. P. Cole, R. M. Dreisbach and H. H. Johnson are incorporators.

St. Louis, Kansas City & Colorado.—Grading is reported practically completed on the extension which this company is building from Stover to Kansas City, Mo., 111 miles. Track has been laid as far as Windsor, 31 miles from Stover. The entire line, from St. Louis to Kansas City, will be approximately 300 miles long, and the contractors are the Stubbs-Flick-Johnson Co., Kansas City, Mo.

San Antonio & Aransas Pass.—It is officially denied that this company has suspended work on its line from Alice, Texas, to Brownsville, 150 miles. Work is still in progress and the first 50 miles have been graded and 15 miles of track have been laid. C. R. Hudson, San Antonio, Texas, is President. (Jan. 8, p. 34.)

Southern.—The newspapers say that this company will soon begin surveys for an extension of its Itta Bena branch from Webb, Miss., northeast to Memphis, Tenn., 85 miles. This line will parallel the Yazoo & Mississippi Valley between these points.

Southern Belt.—Articles of incorporation have been filed by this company in Georgia. It is proposed to build a railroad about three miles long to the north and west of Atlanta, Ga., connecting the different lines of the Southern Railway which enter the city of Atlanta. J. S. B. Thompson, Atlanta, Ga., and others are incorporators.

Wichita Falls & Red River.—An officer writes that work is in progress on an extension of this road from Wichita Falls, Texas, to Byles, 22 miles. The work will include the removal of 250,000 cu. yds. of embankment, one new station and a wooden trestle 540 ft. long. The extension is being laid with 60-lb. rails. J. W. Field, Wichita Falls, Texas, is Chief Engineer.

## GENERAL RAILROAD NEWS.

Canadian Railroads.—The annual report of the Minister of Railroads for the fiscal year ending June 30, 1903, shows that the gross earnings of the (steam) railroads in Canada for the year were $96,064,527, as compared with $83,666,503 for the previous year, an increase of $12,398,024. The operating expenses were $67,481,524 and the net earnings $28,583,003, as compared respectively with operating expenses of $57,343,592 and net earnings of $26,322,911 during the fiscal year of 1902. The number of passengers carried was 22,148,242 in 1903, as compared with 20,679,974 in 1902. The amount of freight carried was 47,373,417 tons, as against 42,376,527 tons the previous year. The total mileage was 19,077 miles, of which 18,714 miles were in operation. Electric railroads, at the close of the fiscal year, had a mileage of 729, of which 201 miles were built during the year.

Choctaw, Oklahoma & Gulf.—At the meeting of the stockholders of this company, on March 24, a vote will be taken on the question of confirming the purchase or lease of the Searcy & Des Arc, the Hazen & Northern and the Little Rock & Southern railroads. A vote will also be taken on the proposition to sell or lease the Choctaw, Oklahoma & Gulf to the Chicago, Rock Island & Pacific.

Delaware & Hudson.—At a meeting of the stockholders of this company, on March 8, 1904, it was voted to increase the capital stock by $10,000,000. This makes the total authorized capital stock of the company $45,000,000. Of the new stock, $5,000,000 will be used for the retirement of the New York & Canada Railway Company's bonds, which mature May 1, 1904. $2,000,000 will be used to pay for the standard gaging of the Chateaugay Railroad, and $3,000,000 will be retained in the treasury of the company for future improvements. Stockholders will be allowed to subscribe to the new issue at 135, with privilege of buying one share of new stock for each seven shares now owned. Of the new subscriptions, 20 per cent. must be paid by March 29, 40 per cent. by April 20, and the remaining 40 per cent. by June 1. The new stock will be issued on June 15.

Grand Trunk Pacific.—At the meeting of Grand Trunk shareholders, in London, on March 8, the agreement with the Canadian Government for the building of the new transcontinental line, the Grand Trunk Pacific, was ratified. Among those present was Charles S. Hays, of Montreal, Vice-President and General Manager of the Grand Trunk, who went over for the special purpose of preventing defeat of the measure. In explaining the plan, Sir Charles Rivers Wilson, President of the company, said it was the most important question ever put before the shareholders of the Grand Trunk. The new line was justified by the flow of prosperity from East to West and the increasing immigration into Canada from the United States.

Missouri Pacific.—At a recent meeting of the stockholders of this company President George J. Gould made the following announcement: "The growing tendency toward consolidation among the railroads east of Chicago and St. Louis has dictated the precaution of taking moderate steps to guard the traffic interests of the Missouri Pacific system against any possible harmful development of this tendency in respect to eastern outlets and sources of business through those gateways. For the purpose of further protecting the investment of the Iron Mountain in the debenture bonds of the Wabash Railroad, the management has deemed it wise to acquire a substantial interest in the preferred stock of the latter company. This interest, while not representing control, is believed to be sufficient to fully cover the purposes which determined its acquisition." The report of the Missouri Pacific Company for the fiscal year ending June 30 last, shows an increase in gross earnings of $5,600,080, and an increase in operating expenses of $4,371,812, leaving an increase in net earnings of $1,128,268. The ratio of operating expenses to gross earnings is 68.3 per cent., as compared with a ratio of 66.8 per cent. in 1902.

New York & Pennsylvania.—The certificate of the reorganization of this company, sold under foreclosure, has been filed with the Secretary of State. The road extends from Canisteo, N. Y., to Ceres, Pa., 57 miles. The capital stock of the new company, which retains the old name, is $570,000 and the directors include F. O. Cobb, Ithaca, N. Y.; Theo. Cobb, Spring Mills, Pa.; H. M. Cook, Hornellsville, N. Y., and others.

New York, New Haven & Hartford.—This company, which has agreed to purchase the stock of the Fairhaven & Westville Railroad Company, will give in exchange scrip certificates, at the rate of $50 per share, dated April 1, 1904, and payable 50 years from that date with 3½ per cent. interest. These certificates are exchangeable for the debentures of the New York, New Haven & Hartford, dated April 1, and running for 50 years with 3½ per cent. interest. All stock or receipts must be deposited prior to March 20.

St. Louis, Iron Mountain & Southern.—See Missouri Pacific above.